22039

APPENDIX B

FINAL
PROJECT-SPECIFIC HEALTH AND SAFETY PLAN
FOR
SOIL VAPOR EXTRACTION
SUBSURFACE INTERIM
MEASURES/INTERIM
REMEDIAL ACTION
EAST TRENCHES AREA

OPERABLE UNIT NO. 2

U.S. DEPARTMENT OF ENERGY

Rocky Flats Plant
Golden, Colorado

ENVIRONMENTAL RESTORATION PROGRAM

FEBRUARY 1994

APPENDIX B

FINAL
PROJECT-SPECIFIC HEALTH AND SAFETY PLAN
FOR
SOIL VAPOR EXTRACTION
SUBSURFACE INTERIM
MEASURES/INTERIM
REMEDIAL ACTION
EAST TRENCHES AREA

OPERABLE UNIT NO. 2

U.S. DEPARTMENT OF ENERGY

Rocky Flats Plant
Golden, Colorado

ENVIRONMENTAL RESTORATION PROGRAM

FEBRUARY 1994

APPROVALS:

Dean Parson
W-C Project Manager

2/9/94
Date

Karen Scudder (acting)
Health and Safety Officer, W-C Denver Business Unit

2/9/94
Date

Jerry Andersen, P.E., CIH
WCFS Corporate Manager, Health and Safety

Feb. 4, 1994
Date

Keith Anderson
EG&G ER Health and Safety Officer

2/9/94
Date

Michael Klein
EG&G ER Program Manager

02-09-94
Date

Lisa Nelowet
EG&G Health and Safety Liaison Officer

02-10-94
Date

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

TABLE OF CONTENTS (continued)

LIST OF APPENDIXES

TABLE OF CONTENTS (continued)

LIST OF ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
APR	air purifying respirator
ASR	air-supplied respirators
bpm	beats per minute
CEO	Corporate Executive Officer
CFR	Code of Federal Regulations
CGI	Combustible Gas Instrument
CHSO	Corporate Health and Safety Officer
CRZ	Contamination Reduction Zone
DAC	Derived Air Concentration for Radionuclides
dBA	decibels on the "A" weighted scale
DOT	Department of Transportation
EMRG	Environmental Management Radiological Guidelines
ER	Environmental Restoration
EZ	Exclusion Zone
F	Fahrenheit
GAC	granular activated carbon
HASP	W-C's Health and Safety Plan
HAZCOM	Hazard Communications
HBV	Hepatitis B Virus
HEPA	High Efficiency Particulate Air
HIV	Human Immunodeficiency Virus
hr	hours
HSL	Health And Safety Liaison
HSO	Health and Safety Officer
HSP	Rocky Flats Health and Safety Practices Manual
HSS	Health And Safety Specialist
HSST	Health and Safety Specialist in Training
HST	Health and Safety Technician
IAA	isoamyl acetate
IDLH	Immediately Dangerous to Life or Health
IHSS	Individual Hazardous Substance Site
IM/IRA	Interim Measures/Interim Remedial Action
IWCP	Integrated Work Control Program
kV	kilovolt
LEL	lower explosive limit
mg/kg	milligrams per kilogram

mrem	one thousandth of a rem
MSDS	Material Safety Data Sheet
MSHA	Mine Safety and Health Administration
MUC	maximum use concentration
NIOSH	National Institute of Safety and Occupational Health
NPCS	Non-Permit Confined Space
OP	Operating Procedure
OU2	Operable Unit No. 2
OSHA	Occupational Safety and Health Administration or Act
OV	organic vapor
PCE	tetrachloroethylene (perchloroethylene)
PEL	permissible exposure limit
PID	photoionization detector
PM	Project Management
PPE	personal protective equipment
ppm	parts per million
PRCS	Permit Required Confined Space
PSHSP	Project-Specific Health And Safety Plan
RCA	Radiological Controlled Area
RCRA	Resource Conservation and Recovery Act
rem	radiation equivalent man - a unit of absorbed dose
RFP	Rocky Flats Plant
RPT	Radiation Protection Technician
SCBA	self-contained breathing apparatus
SHSC	Site Health And Safety Coordinator
SOP	Standard Operating Procedure
STEL	Short-Term Exposure Limit
SVE	Soil Vapor Extraction
SZ	Support Zone
TBD	to be determined
TCA	1,1,1-trichloroethane
TCE	trichloroethylene
TLD	Thermoluminescent Dosimeter
TLV	Threshold Limit Value
TSP	total suspended particulate matter
VOC	volatile organic compounds
WBGT	Wet Bulb Globe Temperature Index
W-C	Woodward-Clyde
WCGI	Woodward-Clyde Group, Incorporated

SECTION B 1
INTRODUCTION

This Project-Specific Health and Safety Plan (PSHSP) provides detailed health and safety guidance for a project planned to investigate Soil Vapor Extraction (SVE) at the East Trenches Areas at the Rocky Flats Plant (RFP).

It is written as an addendum to the previously approved Health and Safety Plan (HASP) written by Woodward-Clyde (W-C) and issued by EG&G Rocky Flats, Inc. (EG&G) for environmental work at Operable Unit No. 2 (OU2) entitled "Health and Safety Plan for Phase II Resource Conservation and Recovery Act (RCRA) Facility Investigation/ Remedial Investigation at the 903 Pad, Mound, and East Trenches Areas." A copy of this plan is required at every location with this Appendix B Plan.

The EG&G-approved health and safety plan for OU2 must be reviewed by all site personnel in conjunction with this PSHSP. It includes sections on:

- EG&G Policy for environmental restoration work conducted at OU2.
- Description of specific locations within OU2.
- Assignment of EG&G health and safety personnel and responsibilities.
- Hazard assessment of OU2 locations including chemical, radiological, physical, and mechanical hazards.
- The EG&G Hazard Communications (HAZCOM) program.
- Site control requirements.
- Personal protective equipment (PPE) requirements.
- Decontamination procedures.
- Medical Surveillance.

- Air monitoring, training, and emergency response requirements.
- Material handling.

Details of the work to be conducted are described in the "OU2 Subsurface IM/IRA – East Trenches Area IHSS 110" (EG&G, October 1992). A summary of the areas in which the soil vapor survey will be conducted is included in Section B 3 of this PSHSP. Section B 4 summarizes the SVE tasks and methods used and the potential hazards present. Additional sections of this PSHSP describe the contractor's health and safety action plan including the elements of site control, PPE, decontamination, medical surveillance, air monitoring, training, and emergency response.

The EG&G project manager is responsible for enforcing the PSHSP. The primary subcontractor and all lower tier subcontractors are responsible for complying with the PSHSP.

This PSHSP provides an Appendix to the Site Safety and Health Plan developed by W-C for Soil Vapor Extraction, East Trenches Area, Operable Unit 2. This document is to be used only in conjunction with the HASP for Phase II RCRA Facility Investigation/Remedial Investigation at the 903 Pad, Mound, and East Trenches Areas.

This PSHSP is designed for use by W-C and W-C subcontractor personnel only. All W-C and W-C subcontractor on-site personnel are required to read the PSHSP and shall agree to abide by the provisions of these documents by signing a Compliance Agreement. In addition, on-site personnel must comply with W-C's Health and Safety Program requirements.

The health and safety guidelines and requirements presented in this PSHSP are based on a review of available information and an evaluation of potential hazards. This PSHSP may be modified by the W-C Project Manager (PM), the W-C business unit Health and Safety Officer (HSO), the W-C Corporate Health and Safety Officer (CHSO), EG&G ER Health and Safety Officer, EG&G

Project Manager, and EG&G Health and Safety Liaison Officer in response to additional information obtained regarding the potential hazards to on-site personnel.

SECTION B 2

SOIL VAPOR EXTRACTION (SVE) PERSONNEL

The following personnel have been assigned to this project. Descriptions of the responsibilities of these positions are included in Table B 2-1 and an organizational chart delineating the interrelationships of the positions is shown in Figure B 2-1.

EG&G Project Manager
Michael Klein

EG&G Health and Safety Liaison
Lisa Nelowet

EG&G Health and Safety Coordinator
Peggy Schreckengast

EG&G ER Health and Safety Officer
Keith Anderson

EG&G Radiological Engineering Representative
Rick Gentry

EG&G Occupational Health Director
F.J. Furman

Woodward-Clyde Project Manager
Dean Parson

Woodward-Clyde Health and Safety Officer
Karen Scudder (Acting)

Woodward-Clyde Site Health and Safety Coordinator (SHSC)/Health and Safety Specialist (HSS)
Gregg Miller

Woodward-Clyde Field Equipment Operators
To be determined

SECTION B 3
SITE DESCRIPTION

The SVE pilot testing will be initially conducted adjacent to an Individual Hazardous Substance Site (IHSS) within OU2 known as IHSS No. 110 (Figure B 3-1). This site is also known as Trench T-3 and is described in detail in Sections 1 and 2 of the "SVE Pilot Test Plan" preceding this PSHSP.

In brief, it is expected that carbon tetrachloride, chloroform, methylene chloride, tetrachloroethylene (PCE), trichloroethylene (TCE), and 1,1,1-trichloroethane (TCA) comprise the majority of released volatile organic compounds (VOC) contaminants at the SVE site. Inorganic contaminants may include uranium, plutonium, americium, and several heavy metals including beryllium.

SECTION B 4
SVE METHODS AND TASKS

SVE methods are described in detail in Sections 2 and 4 of the SVE Test Plan preceding this PSHSP. SVE is a relatively new hazardous waste treatment technology that offers an alternative to the conventional excavation, treatment, and disposal approach. SVE removes volatile contaminants from the subsurface by mechanically drawing air through pore spaces in the soil. The flow of air through unsaturated soil pores enhances volatilization of organic compounds and results in movement of organic vapors (OV) through the soil to extraction vents. The extraction vents are connected to a blower system which draws the contaminant-laden air stream to the surface. The air stream is typically treated for removal of harmful contaminants prior to discharge to the atmosphere. A typical schematic diagram of a single extraction vent system is presented in Figure B 4-1.

The following tasks have been identified for the purpose of health and safety risk analysis:

Task 1 Drilling and sampling

Task 2 Construction of the SVE system

Task 3 Operation of the SVE system

- Groundwater extraction
- Extraction venting

Most of the drilling (Task 1) will be performed using a truck-mounted, hollow stem auger drilling rig. However, drilling for the installation of surface casing may be conducted using a solid stem, continuous flight or bucket auger. Undisturbed soil samples will be collected continuously during hollow stem auger drilling. The samples will be collected using a "California" ring sampler. The sampler will be driven ahead of the auger to the desired depth with a standard 140-pound slide hammer falling freely from a height of 30 inches. The sample will be brought to the surface and removed by opening the sampler along its length or by using an extruder. Soils will be extruded from the appropriate sampling rings, placed on clean butcher or kraft paper and divided so that

no clumps remain. Soil samples will be submitted to a laboratory for VOC and radionuclide analysis.

In general, construction (Task 2) will involve the ordering and delivering of the necessary components; drilling of wells for and installation of groundwater extraction pumps; drilling for and installation of various air extraction and air injection vents; installation of various pressure monitoring probes; and assembly of various piping, blower, granular activated carbon (GAC), high efficiency particulate air (HEPA) filtration, monitoring, tank storage, and power systems.

Once the SVE system is constructed, operations (Task 3) will involve inspection and maintenance of its components; collection, storage, and transportation of potentially contaminated groundwater; and extraction of contaminated soil vapor to the GAC adsorption units. All emergency response and spill control on the project will be conducted according to Health and Safety practice (HSP) 21.04.

SECTION B 5

HAZARD ASSESSMENT

Potential physical, chemical, and radiological hazards that may be encountered during work within OU2 are described in detail in the EG&G HASP (EG&G, 1991). This section will summarize the specific hazards expected to be encountered during the SVE Pilot Study. Recommended PPE is listed in Table B 8-1.

5.1 PHYSICAL HAZARDS

TASK	HAZARD	MEASURES OR CONTROLS TO REDUCE HAZARD
(1) Drilling and Sampling	Noise	Noise exposure may occur during the various drilling and sampling activities. Prior to any activity hearing protection will be donned and noise monitoring will be conducted during the initial activities. If noise exposures exceed 85 dBA, hearing protection will be required; if not, hearing protection can be removed.
	Pinch Points	The SHSC will identify drilling and sampling related pinch points, and will train sampling personnel in safe work practices. The drillers will demonstrate that a kill switch is operational.
	Material Handling	The SHSC will identify items such as augers, core boxes, and other materials which may present lifting/material handling stress and will train drillers/samplers in proper techniques. Site personnel will wear steel toed safety boots to protect their feet, safety glasses with sideshields, and other PPE to prevent personal exposures.
	Overhead	All individuals within a distance equivalent to the height of the boom on the drilling rig will wear a hard hat when the drilling rig is on-site.
	Trip/Fall	Pre-designated routes will be established to prevent trips and falls. Safe housekeeping and material handling techniques will be stressed. Tripping hazards presented by the terrain will be identified and communicated to drillers/samplers.

TASK	HAZARD	MEASURES OR CONTROLS TO REDUCE HAZARD
(1) Drilling and Sampling (Continued)	Electrical	Drillers/samplers will be trained in electrical safety. Ground fault interrupters will be used with all electrical generators and electrically powered equipment.
	Cold Stress	Drillers/samplers will be trained in the symptoms of cold stress. Warm PPE will be worn if temperatures drop below 55 degrees Fahrenheit (F) and PPE will be changed if it gets wet. Direct contact with cold surfaces and air will be avoided. Extra breaks to warm areas may be needed on days below 40 degrees F.
	Heat Stress	If outside temperatures exceed 70 degrees F, driller/samplers will have radial pulse monitored for 30 seconds as early as possible in the resting period. If the heart rate exceeds 110 beats per minute, the next work period will be shortened by 33%. If the heart rate exceeds 110 beats per minute at the beginning of the next rest period, the following work cycle will be further reduced by 33%. Plenty of cool water or other non-caffeinated drinks shall be available. The SHSC shall observe field personnel for symptoms of heat stress. In addition, the most recently published heat stress Threshold Limit Values (TLVs) from the American Conference of Governmental Industrial Hygienists (ACGIH) will be followed using the Wet Bulb Globe Temperature Index (WBGT) to determine the work/rest regimen. See Table B 6-2 for the TLVs and regimen.
	Buried Drums	Screening with a magnetometer or equivalent shall be done to identify the presence of buried drums. Drilling/sampling shall not be attempted above such areas. All intrusive activities shall proceed with caution and will be aborted in locations where buried drums are encountered.
(2) Construction	Noise	Noise exposure may occur during the various drilling and sampling activities. Prior to any activity hearing protection will be donned and noise monitoring will be conducted during the initial activities. If noise exposures exceed 85 dBA, hearing protection will be required; if not, hearing protection can be removed.

TASK	HAZARD	MEASURES OR CONTROLS TO REDUCE HAZARD
(2) Construction (Continued)	Pinch Points	The hazard related to pinch points during construction is considered to be significant. It shall be controlled as discussed above.
	Material Handling	Proper lifting and carrying techniques will be stressed by the SHSC. Devices which minimize physical stress, such as hoists and carts, will be used when feasible.
	Overhead	Hard hats, safety glasses with side shields, and steel toed safety boots will be required during construction by all individuals in the area of construction. Where overhead hazards exist and are identified by the SHSC, hard hats will be required for all individuals in the area of construction. The area will be delineated by caution tape and identified by signage.
	Trip/Fall	Shall be controlled as discussed for Task 1 above.
	Electrical	As per Task 1 above.
	Cold Stress	Shall be controlled as discussed above.
	Heat Stress	As per Task 1 above.
	Buried Drums	As per Task 1 above.
	Flammable Gases	The handling, storage, and use shall be per Occupational Health and Safety Administration (OSHA) and Department of Transportation (DOT) standards. Cylinders shall be secured and non-sparking tools will be used.
(3) SVE Operations	General	Hazards and control measures for Task 3 are, in general, the same as for Task 2. Buried drum and overhead hazards are not expected to be significant for Task 3. If noise exceed 85 dBA, efforts to dampen/control the pump and blower motors will be made, and hearing protection will be required. Other hazards for Task 3 are listed below:

TASK	HAZARD	MEASURES OR CONTROLS TO REDUCE HAZARD
(3) SVE Operations (Continued)	Transportation	Since potentially contaminated ground water will be collected and transported to an RFP treatment facility, typical risks associated with motor vehicles and accidental spills exist. The SHSC shall insure that all drivers are trained in vehicle safety and spill reporting. Periodic audits/inspections will be made to check the adequacy of vehicle and transfer hose maintenance, compliance of drivers with RFP transportation regulations, and adequacy of vehicle safety procedures (such as using wheel chocks or other vehicle restrain methods when loading and unloading tank trucks).
	Explosive/ flammable vapors	This is not expected to be a significant hazard for the SVE since the primary soil contaminants are non flammable chlorinated compounds. However, flammable compressed gases used by the gas chromatograph or during system maintenance (for example, if cutting or welding gases are used) will be used/stored in accordance with OSHA and DOT regulations.
	Explosive/ flammable	Fires can occur in soil vapor extraction systems if high concentration organic "slugs" are processed through activated carbon columns, which can cause an exothermic reaction. The following engineering controls have been added to minimize the fire danger: (1) A flame ionization detector (FID) will be used to measure total organic compound content in both the system feed and the feed to the lead activated carbon column; (2) Three thermostats will be placed in each GAC unit to monitor temperatures at three different levels. Either of these controls will shutdown the system if there are any potential dangers.
	Illumination	During the 24-hour operation of the SVE system, minimum illumination will be provided in accordance with the action levels stated in Table B 6-1. If a component of the SVE system requires repair or maintenance, the repair operation will only be conducted during daylight hours.

A survey for determining the location of underground utilities shall be conducted at each site of intrusive activities. The site shall be cleared by EG&G personnel as free from known utilities or hazards as possible prior to initiating the intrusive activity.

As stated in HSP 15.00, the following precautions shall be taken when working near overhead power lines:

- If work is to be performed near overhead lines, the lines shall be de-energized and grounded, or other safety measures shall be provided before work is started. Protective measure, such as guarding, isolating, or insulating shall be in place to prevent employees from contacting such lines with any part of their body or indirectly through conductive materials, tools, or equipment.

- Employees, other than qualified electrical workers, who work in elevated positions near overhead lines shall not approach overhead lines so that the employee and the longest conductive object he/she may contact cannot come closer to any unguarded, energized overhead line than 10 feet for voltages to ground 50 kV or below, and 10 feet plus 4 inches for every 10 kV over 50 kV.

Prior to the commencement of work, the driller needs to ensure that there is enough room for the mast to be raised safely. The minimum safe overhead clearance on plant site is equal to the maximum mast height plus 10 feet. If buildings or pipes are overhead, additional height could be required to provide safe clearance while raising A-rods and augers above the mast height. The team leader should coordinate with the drilling company to determine clearance requirements for specific drill rigs to be used. W-C's Operating Procedure (OP) 203, Safety Guidelines for Drilling in Soil and Rocks is included in Appendix B-2.

5.2 CHEMICAL HAZARDS

The major organic chemical contaminants present and the levels detected at OU2 in the groundwater include 1,1,1-Trichloroethane (TCA) at 200 µg/l, Carbon tetrachloride at 1,611 µg/l, Chloroform at 2,810 µg/l, Methylene Chloride at 1,600 µg/l, Tetrachloroethylene (PCE) at 2,450 µg/l, and Trichloroethylene (TCE) at 221,860 µg/l (EG&G, 1991). In Appendix B-4, there is an explanation of the estimation of concentrations of contaminants in the air based on the soil or water detection levels. Based on the groundwater concentration, it is estimated that the air concentration of these contaminants would be, 0.00422 parts per million (ppm), 0.0268 ppm, 0.106 ppm, 0.186 ppm, 0.00582 ppm, and 2.75 ppm, respectively. Based on the estimated airborne level, is not likely that the PEL would be reached at any time during the working exposure.

The major chemicals, permissible exposure limits (PEL), TLV, the most important exposure routes, and the major symptoms of exposure are summarized in Table B 5-1. Air monitoring during soil vapor sampling for volatile organic will be performed by the SHSC with a Photoionization Detector (PID) or a detector tube system for carbon tetrachloride and chloroform.

Beryllium is the most chemically toxic metal that is not a radio-isotope present within OU2. The highest level of beryllium found within OU2 is 15 milligrams per kilograms (mg/kg) of sediment (EG&G, 1991). Based on the sediment detection of 15 mg/kg, it is estimated that this could generate about 0.00225 mg/m^3 of beryllium. Based on the estimated dust level, is not likely that the PEL would be reached at any time during the working exposure.

Although overexposure to airborne contamination is unlikely, the SVE technicians shall stay on the upwind side of the drill rig to further reduce exposure potential. To identify the wind direction a wind sock, piece of banner tape or other suitable lightweight material will be placed

be determined by observing the device. Whenever a work activity is being conducted that generates dust, like drilling, the site will be wetted down to minimize the generation of dusts.

5.3 RADIOLOGICAL HAZARDS

Five radionuclide contaminants may be present in particulate form during the SVE pilot study. These five are uranium-238, uranium-235, uranium-234, plutonium-239; and americium-241. The primary type of radiation of concern relative to particulate exposure is "alpha" radiation. Alpha radiation presents an internal hazard when radionuclides in particulate form are inhaled or ingested. The relatively large amount of ionization occurring in a small volume from alpha particulates inside the body is typically 20 times more damaging than ionization caused by X-ray or gamma radiation. Radiation exposure is reduced when the concentration of the radionuclides in the soil is low or the potential for the material to become airborne is low (EG&G, 1991).

The risk of radiation uptake from inhalation during conduct of the SVE is expected to be low because it is distributed throughout large volumes of soil (EG&G, 1991). The risk of uptake through ingestion is also low and can be further minimized by following good hygienic practices such as wearing gloves, washing hands after working around contaminated soil, and not smoking, drinking, or eating in or around the contaminated areas. The highest potential for contamination occurs within 1 foot of the contaminated soil where the dust level is highest.

Because the level radiation is low, no acute health effects are expected to be experienced. The chronic low level radiation health effects include the following. Generally ionizing radiation can eventually cause cells to be damaged or become incapable of life. If enough cells in one area, such as an organ, are damaged, the organ ceases to function. Cell damage can be genetic damage that is passed on to the next generation. Target organs for radiation include the bone or skeletal system, blood, kidney, liver, lungs, skin, and eyes. Exposure to radiation has also been associated with higher-than-normal incidences of skin, lung, and other cancers.

Since the exposure to radiation can cause serious health effects, it is important to assess the amount of these materials present and the potential for exposure during work operations. Plutonium-^{239} is the most hazardous radionuclide present in the SVE soils. If adequate protection is taken for plutonium, protection will also be adequate for other alpha emitting radionuclides (EG&G, 1991).

The derived air concentration (DAC) is the concentration of a single radionuclide in air, which if inhaled over a 1-year period would irradiate a person to the occupational exposure limit of 5 rem per year. In general, 1/10 of the DAC is the action level for upgrade to a full-face respirator.

5.3.1 Radiological Monitoring and Screening

Radiological monitoring and screening will be conducted by the HST. Radiation meter deflections above background will be logged/recorded. Radiation levels which exceed 5 mrem/hr are subject to the Environmental Management Radiological Guidelines (EMRG) 1.3. Table B 5-2 shows the information that will be used to ensure that airborne concentrations are maintained below the DAC during field operations. This procedure was developed by RFP Environmental Restoration personnel and will be implemented by the subcontractor in the areas of suspected contamination of soils (EG&G, 1991).

Personnel will be "frisked" with the appropriate radiological instruments prior to leaving any area suspected of containing radiological hazards. All radiological monitoring shall be conducted in accordance to EMRG 1.3, 2.1, 3.1, and 3.2. Likewise, all instrumentation for radiological monitoring will be in accordance to the EMRG.

A Health and Safety Specialist in Training (HSST) that is familiar with how to operate the radiological monitoring equipment will be present at each activity that requires radiation

monitoring. The HSST are considered to be semi-skilled radiological monitors and will conduct the day-to-day monitoring activities, immediately implement the action levels in Section B 6 and notify the EG&G Health and Safety Liaison (HSL) of all monitoring results. Arrangements will be made for a Health and Safety Specialist (HSS) to verify any of the HSSTs radiological monitoring results that indicate the presence of greater than 250 counts per minute (cpm) of alpha contamination or 300 cpm of beta or gamma contamination. The HSS will have in depth familiarity and experience in radiation monitoring, and be approved by radiation engineering.

Surfaces that could have contamination present shall be decontaminated in accordance to the Field Operations SOP FO.03 on that subject. The release of property shall be conducted in accordance to Radiological Engineering 1003, EMRG 3.2 Draft E and HSP 18.10.

5.4 BIOLOGICAL HAZARDS

Snakes, arachnids, and insects are the major biological hazards that may be encountered at the RFP. Care should be taken when performing field work at the facility. Wearing hightop work boots will provide some measure of protection. Leather work gloves are also recommended when handling items on or near the ground. In the unlikely event of a snake bite or other bite, the following procedures should be followed.

- Call an emergency medical service or get the victim to a medical facility as soon as possible.
- Keep victim calm and still. Snakebite reactions are aggravated by anxiety and fear.
- Keep bitten area below level of heart, if possible, and keep it immobile.
- Treat for shock, if necessary.
- Give mouth-to-mouth resuscitation if breathing stops.
- Begin cardiopulmonary resuscitation (CPR) if breathing and heartbeat stop.

- Do not give victim aspirin.
- Do not use ice on the bite.

Mortality rates of rattlesnake bite victims are low, but crippling injuries can result. Medical care should be sought even if the victim shows no adverse reactions.

The following biological hazards could be encountered in the field and precautions should be taken to protect field personnel:

Prairie Rattlesnake: The prairie rattlesnake generally has brown blotches giving way to crossbands on its tail. The blotches are usually well defined and the entire body has a greenish cast. Another characteristic of rattlesnakes is interlocking joints at the end of the tail that make a sharp rattling noise when shaken. Field personnel need to be aware that snakes could be in the area and should exercise caution when working in undisturbed areas and locations with animal dens. Extra care should be taken around rocks, particularly those with overhangs. Rattlesnakes are generally timid and will not attack unless disturbed.

Black Widow Spiders: The black widow spider has a black shiny body about the size of a pea. The abdomen is the shape of a sphere and there is a red or yellow hourglass-shaped mark on the underside of abdomen. There are usually found in shady areas or under rocks and wood. It weaves shapeless webs in undisturbed areas. A bite could result in severe pain, illness, and possible death from complications, but not usually from the bite itself.

Scorpions: There are several types of scorpions native to Colorado. Scorpions can be green or brown to yellowish in color and range from 1/2 inch to 8 inches in length. Their bodies are divided into two parts - a short, thick, upper body and a long abdomen with a six-segmented tail with venomous sting at the end. A scorpion has six pairs of jointed appendages -- one pair

of small pincers, one pair of large claws, and four pairs of jointed legs. They are most active at night. A scorpion sting is very painful, but usually will not result in death.

Wood Ticks: Ticks are external blood feeding parasites. Bites from tick could result in the transmission of Rocky Mountain Spotted Fever, a serious and possibly fatal disease. The *Rickettsia* virus infects wood ticks, mostly in the late spring and early summer. It is characterized by chills, fever, severe pain in leg muscles and joints, and a body rash. Personal protective equipment can offer some protection, but the use of insect repellent on outside clothing could also be warranted. Field personnel should search their bodies at the end of each day to check for ticks and chiggers.

Violin Spider: Also known as the "Brown Recluse Spider". These spiders are 1/4 to 3/8 inches in length. The bases of its legs are orange -yellow with the rest of the legs grayish to dark brown. The abdomen is grayish to dark brown with no obvious pattern. Each foot has two claws. Its habitat is in cornered areas. These spiders sometimes take refuge in towels or articles of clothing. Their venom is particularly poisonous to people and the wound commonly develops a crust which falls off leaving a deep crater which does not heal for months.

Other biological hazards include chiggers, wasps, bees, and poison ivy. Bees and wasps are especially dangerous to people who have allergic reactions to their venom. Workers who are sensitive to insect stings are responsible for notifying the SHSC/HSS, the HSST, the field team leader, and the project manager prior to the commencement of field work.

SECTION B 6
MONITORING

Table B 6-1 indicates the air and personal monitoring instruments, frequency of monitoring, action limits, and action required for all work conducted as a part of the SVE.

Organic vapors cause a PID to respond at various efficiencies due to the ionization potential of the compound. Based on the ionization potentials and the relative response factors for the HNu readings observed on the instrument, correction factors need to be used to calculate the real-time measurement. HNu lists the following relative responses:

Compound	HNu Relative Response to Benzene for 11.7ev lamp	HNu Correction Factor to Isobutylene for 11.7ev lamp
Carbon Tetrachloride	9	1.11
Chloroform	6	1.67
Methylene Chloride	9.4	1.06
Tetrachloroethylene	None established - assume 5	2
1,1,1-Trichloroethane	9	1.11
Trichloroethylene	None established - assume 5	2

Thus, in order to determine the actual amount of contaminant being measured, multiply the meter reading by the correction factor. For example, if the instrument says 10 ppm, and is being monitored for Chloroform, then 10 x 1.67 = 16.7 ppm of Chloroform is the real-time measurement. These calculations were taken into account when determining the action levels. It was assumed that the HNu will be calibrated to isobutylene. It will not be necessary to use the calculations during field activities.

In addition to the above monitoring equipment, an oral thermometer shall be kept on-site to monitor body temperature (in particular, to check for heat or cold stress).

The above tables can be modified by the contractor to include more stringent actions if any unexpected compounds are discovered during the analysis of SVE results.

SECTION B 7

EXPOSURE SYMPTOMS AND ACTION REQUIRED

Specific exposure conditions/agents, warning symptoms, and actions required during this SVE project if warning symptoms are encountered are specified in Table B 7-1. Actions required if radiation or chemical exposures occur are given in Sections B 5 and B 6.

SECTION B 8
PERSONAL PROTECTIVE EQUIPMENT

Work on this project will begin in level C respiratory protection. Upgrading to level B respiratory protection or downgrading to level D respiratory protection will proceed depending on how air monitoring results compare to action levels identified in Section B 6. Tables B 8-1 and B 8-2 specify the PPE required.

SECTION B 9
WORK ZONES

The SVE site will be divided into three basic zones: 1) Exclusion Zone, 2) Contamination Reduction Zone, and 3) the Support Zone. The Exclusion Zones (EZ) include areas of high physical, chemical, or radiological hazards. Only authorized personnel are permitted within the exclusion zones. Examples of exclusion zones are a 40-foot radius around a drill rig, or at least one-mast length, and areas where hard hats or respiratory protection is required. The exclusion zone will be clearly marked with traffic cones, banner tape, or other high visibility markings, and in accordance with Environmental Management Radiological Guidelines (EMRG) 1.3 and 9.1.

The Contamination Reduction Zone (CRZ) or decontamination area is the corridor through which all authorized personnel may enter or exit from the exclusion zone. The CRZ contains decontamination equipment and containers for disposable outerwear, etc. The CRZ is located on the upwind side of the EZ. Entrances and exits are clearly marked with high visibility items such as traffic cones, banner tape or other high visibility markings.

The Support Zone (SZ) contains personnel who perform support functions for the physical work and a break area. It is upwind of the CRZ. Managers, spare equipment, etc., are generally located in the SZ. All personnel exiting the EZ must be decontaminated prior to entering the SZ. Heat stress monitoring is performed in the SZ.

Contamination prevention techniques will be used wherever feasible. Monitoring equipment will be wrapped in plastic to prevent possible contamination and to minimize decontamination, to the extent possible, without interfering with their function. The plastic will be discarded as contaminated waste after each day's use.

Engineering controls will be used first, wherever feasible, followed by a combination of administrative and personal protective equipment controls. The possibility of significant dust

generation during SVE is considered to be low. Whenever work activities on the site have the potential to generate dust, the area will be wetted down with a garden type sprayer, or equivalent.

SVE technicians will be wearing full-face respirators at the beginning of work until monitoring confirms that they are no longer needed. PPE will be used when other controls are not feasible or will not adequately control potential exposures.

All equipment to be used by personnel will be checked to ensure proper function and to make sure that all calibration/safety checks have been performed to manufacturer's specifications prior to use in the field. Testing of the breathing zone atmosphere is required for OSHA documentation. If special hazards are identified, appropriate equipment must be selected to assess the hazard level. The instruments selected must detect all suspected hazards, substances, agents, or materials of concern (radiation, VOCs, and dust/particulate hazards). W-C's respiratory protection operating procedures are included in Appendix B-2.

Equipment and instrument calibration, safety and function checks, and the daily safety briefings will be documented in the field logbook. Results of monitoring during field work will be documented in the field logbook. Incidents, exposures, accidents, and other health and safety problems or conversations relating to field activities will also be documented as appropriate.

Only authorized personnel are permitted to enter the EZ. Authorized personnel are those pre-approved personnel, named in this PSHSP, or personnel that are given a site safety briefing by the SHSC and approved by the SHSC for entry into the exclusion zone. The personnel allowed into the EZ are those who are needed in the EZ to perform essential site functions or those visiting the site for auditing or informational purposes (tour).

Additionally, if work is to be done in Radiological Controlled Areas (RCAs) a Radiological Work Permit is required. All work in the RCA shall be done in accordance to EMRG 1.3 with

applicable EMRGs. EG&G Radiological Engineering Department is responsible for delineating the RCAs in accordance with HSP Chapter 18, Radiological Engineering Practices.

The following are the Confined Space Entry procedures to be followed for entry into a confined space on this project. The confined space entry will be conducted via Integrated Work Control Program (IWCP). The work will be conducted in accordance with W-C's Health and Safety Operating Procedure 205 and EG&G's Health and Safety Policy 6.04. Whenever there is a doubt over which procedure to use, EG&G's HSP 6.04 will be followed.

The tasks to be performed on the project are:

1. Complete a Confined Space Entry Checklist/Permit and have it approved by the appropriate people;
   - Occupational Safety
   - H&S Area Manager
   - Industrial Hygiene
   - Fire Department
   - RAD Protection
   - Job Supervisor
   - W-C Project Manager
   - W-C Health and Safety Officer
   - W-C Site Manager
   - W-C Site Health and Safety Coordinator

2. Conduct a pre-evaluation site briefing to assign duties to various personnel;

3. Conduct pre-entry air monitoring for hazardous atmospheres including oxygen deficiency, explosivity, and toxic gases. This will be conducted by Peggy Schreckengast, EG&G Industrial Hygiene;

4. Coordinate (as specified in HSP 6.04) with the Fire Department for rescue from the confined space if needed in an emergency. All emergency rescue will be conducted by the EG&G Fire Department.

5. Post and rope off the area to be entered;

6. Enter a new aboveground storage tank that has never contained any product other than air;

7. Perform the work in the tank (unscrew and remove the pipe);

8. Secure the area after the work in completed;

9. Return a copy of the checklist/permit to the project manager.

SECTION B 10

DECONTAMINATION

Decontamination at RFP is designed to eliminate the transfer of contamination from one site to another, and to reduce the possibility of personnel coming into contact with contamination. Decontamination will include:

- Personnel
- General Equipment
- Heavy Equipment

Refer to Manual No. 5-21000-OPS.FO.03, .04 and .06 for decontamination procedures and F.05 and .07 for the handling of decon water and rinse water.

10.1 PERSONNEL

Discard disposable outerwear. Solid wastes will be placed in a plastic bag, labelled and transferred to RFP for proper disposal. Liquid wastes will be containerized and transferred to RFP for proper disposal. Non-disposable personnel protective equipment should be washed with soap and water and placed in a plastic bag for late use. Wash exposed skin with soap and water. Rinse with water.

10.2 FIELD MONITORING EQUIPMENT

Remove and dispose of plastic wrapping. All potentially exposed surfaces will be wiped with a cloth dampened with soap and water after each use and housed in a trailer on the RFP site. Effectiveness of decontamination will be checked by frisking or wipe testing each instrument. Contaminated equipment is not permitted to be stored in general use areas or to leave the site. Decontamination wash and rinse water will be disposed of in the client's approved disposal area or as stated in the contract.

10.3 EQUIPMENT

Rental equipment will be washed and wipe tested for removable surface contamination. Equipment will not be removed from the site until RFP determines that it is safe for use by the general public (obtain written RFP approval). A copy of the RFP approval will be maintained in the project file.

All equipment, regardless of ownership, shall be monitored in accordance to RFP Safety Standards per the Rocky Flats Health and Safety Practices Manual Section 18.10 and Department Of Energy Orders 5480:11 before leaving plant site.

10.4 VEHICLES/HEAVY EQUIPMENT

Vehicles and heavy equipment used in potentially radioactive areas will be surveyed for radioactive contamination prior to leaving the RFP facility. Vehicles must meet facility decontamination standards before exiting the site (obtain written RFP approval).

SECTION B 11
TRAINING REQUIREMENTS

All field personnel will have completed and be current in the training specified in 29 Code of Federal Regulations (CFR) 1910.120. This training includes, but is not limited to:

40-hour Hazardous Waste Site Worker Training
8-hour annual refresher training
8-hour supervisory training (field supervisors only)
24-hour on-the-job training
8-hour Environmental Restoration Radiation Worker Safety Training

The 8-hour Environmental Restoration Radiation Worker Safety Training is a requirement for all field personnel. It is specialized training given at RFP specifically for personnel in the field performing environmental work who could potentially be exposed to sources of ionizing radiation.

In addition to the above training, the SHSC shall train all personnel working in the field on HAZCOM, an initial site safety briefing, and daily safety or tailgate briefings including information on pinch points, material handling hazards, and other hazards listed in Section 5.0. All training must be documented and copies of the documentation provided to EG&G Rocky Flats and maintained in the field in an accessible location. Appendix B3 contains tables of personnel training status and required personnel training.

SECTION B 12

MEDICAL MONITORING REQUIREMENTS

All field personnel are participants in a medical monitoring program which fulfills the requirements of 29 CFR 1910.120. The program includes:

Baseline Medical Examination

Annual Medical Examination (or as frequent as required by a Physician)

Exit Medical Examination

Incident Specific Examination

Bioassay For Radiological Constituent

The protocol for W-C's medical surveillance program is included in Appendix B-2. All personnel who are required to wear a respirator must be medically fit according to an occupational physician to wear a respirator according to 1910.134.

SECTION B 13
CONTINGENCY PLANS

The concentrations of chemical and radiological contaminants are suspected to be low. Site emergencies are therefore expected to be limited to the slip, trip, fall, cut, and abrasion variety. The highest potential for injuries is expected to occur during drilling and construction operations..

If emergencies arise, the injuries will be stabilized by trained personnel using standard first aid practices. All injuries will be documented in the field logbook and reported to the contractor's project manager and/or SHSC. Minor injuries and cuts will be treated by the field workers using basic first aid procedures and materials. Additional medical attention will be sought if the worker's injury requires more than basic first aid measures or the condition worsens.

Injuries which require more than simple first aid measures will be treated by medical personnel (at the RFP or at Avista Hospital).

- Exposures or suspected exposures to chemical or radiological hazards will be evaluated by SHSC. If treatment is required, the individual will be taken to a hospital without delay. Effective diagnosis and treatment sometimes require the individual to be tested within hours of the suspected exposure. After rendering first aid and transport to the medical facility, the exposure will be reported to the contractor's project manager or SHSC as soon as possible.

- If chemically-contaminated soil, dust or water gets in the eyes, first flush eyes with emergency eye wash. Phone emergency response personnel and transport to medical clinic and flush eyes with water for 15 minutes. Remember to occasionally lift the upper and lower lids during flushing.

- If chemically-contaminated soil, dust or water gets on the skin, flush the affected skin with water for 10-15 minutes. Phone emergency response personnel.

- If chemically-contaminated soil, dust or water is ingested, call emergency medical personnel.

- If chemically-contaminated soil, dust or water is inhaled, move the victim to fresh air at once. Call emergency personnel.

Ambulance:	Building 331 - Phone: 966-2911 RFPFD
Hospital:	Phone: 966-2911 or
	During 24-hour operation, Avista Hospital 673-1000
Police:	Phone: 966-2911
Fire:	Phone: 966-2911

A project phone list is included in Table B 13-1.

SECTION B 14

SAFETY COMPLIANCE AGREEMENT AND DOCUMENTATION OF SITE SAFETY BRIEFING

Date/Time:_____ Site of Briefing:_____

Topics Covered During the Briefing:

___ Extent and concentration of chemical and radiological hazards on site
___ Health effects of chemical and radiological hazards
___ Physical hazards on site
___ Levels of protection required
___ Route to hospital/clinic
___ Monitoring Procedures
___ Action levels
___ Decontamination procedures
___ Hazard Communications Training
___ Location of Emergency Numbers
___ Location of Emergency Equipment (first aid kit, fire extinguisher, eye wash...)

I, the undersigned, have received a copy of the health and safety plan (including Appendix B) for the referenced project. I have been given the above verbal briefing and understand the hazards of the working at the site. I will comply with all the health and safety requirements. I am a participant in a medical monitoring program according to 29 CFR 1910.120, possess a current certification for my hazardous waste operations training according to 29 CFR 1910.120 and a current respiratory fit test according to 29 CFR 1910.134 (if required). I understand that I may be prohibited from working on the project for violating any of the requirements.

Name: (print)_____

(signature)_____

Date:_____

Company:_____

___ Verification that health and safety plan has been received and read
___ Verification that briefing was understood (May require verbally quizzing participants or verifying comprehension of English.)
___ Verification of documentation of medical monitoring and required training.

SHSC (signature) _____

SECTION B 15

REFERENCES

EG&G. 1991. Final Health and Safety Plan for Phase II RCRA Facility Investigation/Remedial Investigation at the 903 Pad, Mound, and East Trenches Areas.

EG&G. 1991. Environmental Management Radiological Guidelines.

TABLES

TABLE B 2-1

POSITION RESPONSIBILITIES

PERSON	RESPONSIBILITIES	AUTHORITIES
WCGI President and Chief Executive Officer Jean Yves Perez	Monitor the implementation of the Health and Safety Program Provide leadership and adequate resources for health and safety	Direct changes in the Health and Safety Program Determine and implement personnel disciplinary actions, as required
W-C Operations Management Robert Masterson	Provide leadership and adequate resources for health and safety Communicate regularly with the CHSO and HSO regarding health and safety Monitor the implementation of the Health and Safety Program within the operations area of responsibility	Determine and implement personnel disciplinary actions, as required Appoint the CHSO and HSO in cooperation with the health and safety matrix manager Suspend work on a project that jeopardizes the health and safety personnel
W-C Project Manager Dean Parson	Assure that projects are performed in a manner consistent with the Woodward-Clyde Health and Safety Program Assure that the project Health and Safety Plans are prepared, approved, and properly implemented when required Implement Health and Safety Plans Assure that adequate funds are allocated to fully implement project health and safety Coordinate with the HSO on health and safety matters	Assign an HSO-approved Corporate Health and Safety Officer (CHSO) to project and, if necessary, assign a suitably qualified replacement Suspend field activities, if health and safety of personnel are endangered, pending an evaluation by the HSO and/or CHSO Suspend an individual from field activities for infractions of the Health and Safety Plan, pending an evaluation by the HSO, CHSO, and/or WCGI Health and Safety Manager

TABLE B 2-1

POSITION RESPONSIBILITIES

PERSON	RESPONSIBILITIES	AUTHORITIES
WCGI Health and Safety Manager Phil Jones	Administration of the Health and Safety Program Track health and safety regulations that affect W-C Maintain records pertaining to medical surveillance, training, fit testing, chemical exposure, and incidents Update Woodward-Clyde Health and Safety Manual Manage the employee medical surveillance program Audit key aspect of Health and Safety Program and report effectiveness to Corporate Executive Officer (CEO) Supervise CHSOs through a matrix management system Provide practice leadership for the occupational safety and hygiene practice	Implement improvements to the Woodward-Clyde Health and Safety Program Approve the health and safety qualifications of employees Approve or disapprove Health and Safety Plans Establish employee training and medical surveillance procedures Establish employee training and medical surveillance procedures Suspend work on any project that jeopardizes the health and safety of personnel Determine the types of occupational safety and industrial hygiene services to be provided by W-C

TABLE B 2-1

POSITION RESPONSIBILITIES

PERSON	RESPONSIBILITIES	AUTHORITIES
W-C Corporate Health and Safety Officer (CHSO) Jerry Andersen	Direct the implementation of the Health and Safety Program of the Operating Group (or responsibility area) and provide recommendation of improvement of the program Coordinate health and safety activities of the Operating Group Determine need for project Health and Safety Plan Maintain a high level of understanding regarding health and safety regulations affecting W-C Review and approve Health and Safety Plans Monitor implementation of Health and Safety Plans Investigate reports of incidents or accidents and report to Health and Safety Manager Provide employee health and safety training in the Operating group, particularly refresher training Determine whether an accidental exposure or injury merits a change in the affected individual's work assignments and whether changes in work practices are required Coordinate Operating Units with regard to health and safety equipment needs Supervise HSOs through a matrix management system, in cooperation with the Operating Unit	Approve or disapprove Health and Safety Plans Direct Operating Unit HSO to prepare project Health and Safety Plans Access and review project files Direct changes in personnel work practices to improve health and safety of employees Remove individuals from project, if their conduct jeopardizes their health and safety or that of co-workers Suspend work on any project that jeopardizes the health and safety of personnel involved

TABLE B 2-1

POSITION RESPONSIBILITIES

PERSON	RESPONSIBILITIES	AUTHORITIES
W-C Operating Unit Health and Safety Officer (HSO) Karen Scudder (Acting)	Administer the Health and Safety Program within the Operating Unit Maintain a working understanding of key government health and safety regulations and W-C health and safety policies Interface with project managers in matter of health and safety Report to CHSO on health and safety matters Develop or review, approve or disapprove project Health and Safety Plans prior to submittal to the CHSO for review Conduct staff training and orientation on health and safety related activities Appoint or approve SHSCs Monitor compliance with Health and Safety Plans and conduct site audits Assist project managers in obtaining required health and safety equipment Approve personnel to work on hazardous waste management projects with regard to medical examinations and health and safety training Answer employee questions and concerns regarding health and safety	Suspend work or otherwise limit exposure to personnel, if health and safety risks are unacceptable Direct personnel to change work practices, if existing practices are deemed to be hazardous to health and safety of personnel Remove personnel from projects, if their actions or conditions endanger their health and safety or the health and safety of co-workers

TABLE B 2-1

POSITION RESPONSIBILITIES

PERSON	RESPONSIBILITIES	AUTHORITIES
W-C Site Health and Safety Coordinator (SHSC) Gregg Miller	Direct health and safety activities on-site Report immediately all safety related incidents or accidents to the HSO and project manager Assist project managers in all aspects of implementing Health and Safety Plans Maintain health and safety equipment on-site Implement emergency procedures as required Review of certifications/medical surveillance status of personnel prior to site access.	Temporarily suspend field activities, if health and safety of personnel are endangered, pending further consideration by the HSO and/or CHSO Temporarily suspend an individual from field activities for infractions of the Health and Safety Plan, pending an evaluation by the HSO and/or CHSO

TABLE B 2-1

POSITION RESPONSIBILITIES

PERSON	RESPONSIBILITIES	AUTHORITIES
Health and Safety Technician (HST) As assigned by the Site Manager and Project Manager in concurrence with the HSO	The HSTs shall assist the SHSC in implementing site Health and Safety Plans (HSP). An HST will be present (in the immediate vicinity) during all activities involving drilling, trenching, or sampling of wastes or soils. None of these activities shall be permitted in the absence of an HST. • Ensure that each individual within his/her jurisdiction complies with the provisions of the HSP. • Provide on-site air monitoring during field activities. • Audit safety practices used by on-site teams. • Communicate with command post for on-site activities. • Supervise decontamination, monitor workers for heat or cold stress, and distribute health and safety equipment. • Document safety practices. • Initiate appropriate emergency procedures.	• The health and safety technician shall have the authority to stop work in case of an imminent safety hazard or potentially dangerous situation. After stopping work, the health and safety technicians shall immediately consult the CHSO.

TABLE B 2-1

POSITION RESPONSIBILITIES

PERSON	RESPONSIBILITIES	AUTHORITIES
W-C Health and Safety Specialist (HSS) Gregg Miller	• Conduct surveys and document the results, as required by the EMRGs, the PSHSP, and the EG&G Rocky Flats Plant Site-Wide SOPs • Supervise Health and Safety Specialist in-training (HSST) during field activities • Countersign all reports/forms completed by the HSST • Forward completed survey reports/forms to the SHSC • Notify the SHSC of survey results that indicate radiation levels exceeding 5 mrem/h, levels requiring access controls not already established, or levels exceeding an established action level • Control access and advise all personnel when radiological precautions are required • Complete performance and operational checks required for radiation instruments and make entries in the Instrumentation Field Log Book	Temporarily suspend field activities, if health and safety of personnel are endangered, pending further consideration by the HSO and/or CHSO Temporarily suspend an individual from field activities for infractions of the Health and Safety Plan, pending an evaluation by the HSO and/or CHSO

TABLE B 2-1

POSITION RESPONSIBILITIES

PERSON	RESPONSIBILITIES	AUTHORITIES
Health and Safety Liaison Officer Lisa Nelowet	• Coordinate health and safety activities with the Environmental Management H&S Officer and the Environmental Management Site Project Managers. • Supervise the EG&G Site H&S Coordinators at each OU • Coordinate health and safety guidance for hazardous waste operations in HWAs • Coordinate preparation and approval of OU and HWA Health and Safety Plans • Coordinate quarterly health and safety audits and inspections of health and safety program and program documentation for subcontractors for hazardous waste operations • Coordinate review of OU workplans with the Environmental Management H&S Officer • Perform formal audits of EG&G Hazardous Waste Operations Training Courses on an annual basis. The purpose of these audits is to ensure compliance with OSHA requirements for hazardous waste operations training • Coordinate review and approval of Health and Safety Plan field changes	

TABLE B 2-1

POSITION RESPONSIBILITIES

PERSON	RESPONSIBILITIES	AUTHORITIES
Subcontractor Health and Safety Specialist-in-Training (HSST) Kent Trimbach Tracey Hines Doug Schroer alternate: Michael Ryan Rock Powell Robert Lahn Kathleen Fischer	• Participate in a formal training program designed to qualify subcontractor employees to be designated as Health and Safety Specialists by the EMRE. • Conduct surveys and document the results as required by the EMRGs, the PSHSP, and the EG&G Rocky Flats Plant Site-Side SOPs. • Notify the HSS of unanticipated radiation and contamination levels such as a lack of radioactivity where radioactivity is known to be present, or radiation or contamination levels.	• The health and safety technician shall have the authority to stop work in case of an imminent safety hazard or potentially dangerous situation. After stopping work, the health and safety technicians shall immediately consult the CHSO.

TABLE B 5-1
CHEMICAL HAZARDS

Chemical Name	Groundwater Detection Level	Estimated Airborne Concentration	OSHA PEL	ACGIH TLV	Route of Entry	Symptoms of Exposure
Carbon tetrachloride	1,611 µg/l	0.0268 ppm	2 ppm TWA	5 ppm TWA A2 Carcinogen	Inh., Abs., Ing., Con.	CNS depression, nausea, liver/kidney damage.
Chloroform	2,810 µg/l	0.106 ppm	2 ppm TWA	10 ppm TWA	Inh., Ing., Con.	Irritate eyes, skin; dizziness, nausea, headache, fatigue, liver damage, cancer.
Methylene Chloride	1,600 µg/l	0.186 ppm	25 ppm TWA 125 ppm S	50 ppm TWA	Inh., Ing., Con.	Fatigue, lightheadedness, nausea, numbness in limbs, eye irritation, (Cancer)
Trichloroethylene	221,860 µg/l	2.75 ppm	50 ppm TWA 200 ppm S	50 ppm TWA 200 ppm S	Inh., Ing., Con.	Headache, dizziness, visual disturbance, nausea.
1,1,1-Trichloroethane	200 µg/l	0.00422 ppm	350 ppm TWA 450 ppm S	350 ppm TWA 450 ppm S	Inh., Ing., Con	Headache, CNS depression, irritate eyes and skin, irregular heart bear.
Tetrachloroethylene	2,450 µg/l	0.00582 ppm	25 ppm	50 ppm 200 ppm C	Inh., Ing., Con.	Irritate eyes, nose, throat; nausea, CNS depression, decreased alertness, headache, liver damage (cancer).
Beryllium	15 mg/kg (sediment)	0.000225 mg/m^3	0.002 mg/m^3 TWA 0.005 mg/m^3 C	0.002 mg/m^3TWA	Inh.	Respiratory irritation, weakness, fatigue, weight loss, cancer.

Key: Abs Skin Absorption; Con Skin and/or eye contact; C Ceiling Concentration; Inh Inhalation; CNS Central Nervous System; S Short Term Exposure Limit; Ing Ingestion; TWA Time Weighted Average

TABLE B 5-2

BREATHING ZONE MONITORING TRIGGER LEVELS FOR ^{239}PLUTONIUM IN SOILS*

Soil Activity pCi/gram	DAC/10 TSP mg/m^3
0.001	2,000,000
0.01	20,000
0.1	2,000
1	200
5	40
10	20
20	10
40	5
60	3
80	3
100	2
200	1
400	0.5
600	0.3
800	0.3
1,000	0.2
1,500	0.13
2,000	0.10
5,000	0.04
10,000	0.02
20,000	0.01
50,000	0.004
80,000	0.003
100,000	0.002

* Trigger levels are for Total Suspended Particulate matter (TSP) concentrations measured in the breathing zone as 8-hour, time-weighted averages. They are based on (1) the Derived Air Concentration (DAC)/10 which DOE recognizes as the criteria for implementing respiratory protection.

Use of the Table B 5-2

1) Identify the approximate soil activity in the area where intrusive activities are to be conducted.
2) Identify the corresponding DAC/10 and annual committed effective dose equivalent trigger levels. Those values represent total suspended particulate (TSP) concentrations that trigger the following actions:
   A) *Donning respiratory protection equipment:* DAC/10 threshold.
   B) Stop intrusive actions and reevaluate the activities, conditions, and precautionary requirements: 1.0 rem/yr TSP threshold.
3) Measure TSP breathing zone concentrations during intrusive activities using a Piezometric Balance, Mini-RAM, or comparable real-time instrument.
4) If measured TSP concentrations attain the trigger levels identified above, for a sustained period of time (15-30 minutes), such that the 8-hour time-weighted average could be approached, follow the appropriate requirements identified above (A or B) and notify the SHSC.
5) RFP practice dictates that reasonable measures be taken to keep exposures to radionuclides as low as reasonable achievable (ALARA). Routine dust avoidance procedures such as avoiding the dust plume path should be implemented, to the extent practicable, regardless of the TSP measurements.
6) Environmental concentration measurements and estimates can vary at a given location. Thus, users of this table are encouraged to exercise conservative judgment regarding the selection of trigger levels.

Source: *EG&G, Industrial Hygiene.*

TABLE B 6-1

AREA AND PERSONAL MONITORING ACTIONS LIMITS

Physical Hazard	Instrument	Frequency	Action Limit	Action
Heat Stress	Pulse Check (heat stress)	(H)	50-110 beats per minute (bpm)	Continue work. If approaching 110 bpm, reduce work load to minimize heat stress.
			>110 bpm	No field work permitted. Rest in cool location. Drink cool fluids.
Heat Stress	WBGT	(H)	70°F	See Table B6-2
Illumination	Light Meter	(D)	5 foot-candles	General site areas, excavation and waste areas, accessways, active storage areas, loading platforms, refueling, field maintenance areas, warehouses, corridors, hallways, exitways, tunnels, shafts, and general underground work areas.
			10 foot-candles	Mechanical and electrical equipment rooms, active storage rooms, locker or dressing rooms, dining areas, and indoor toilets and workrooms
			30 foot-candles	First aid stations, infirmaries, and offices
Noise	Sound Level Meter	(H+D)	< 85 dBA	Site work may be conducted without hearing protection
			> 85 dBA	Hearing protection must be work during site work
Chemical Hazard	**Instrument**	**Frequency**	**Action Limit**	**Action**
Organic Vapors	Photoionization Detector (PID, HNu 11.7 eV lamp)	(H + D)	0-1 ppm	Level D, no respiratory protection required to be worn.
			1-10 ppm	Level C respiratory protection required. Respirator equipped with combination cartridge approved for organic vapors (OV) and high efficiency particulate air (HEPA) filter.
			>10 ppm	With draw from site or go to Level B protection.
Carbon Tetrachloride	Detector Tubes	(H+D)	0-1 ppm	Level D, no respiratory protection required to be worn.
			>1 ppm	Withdraw from site or go to Level B protection.
Chloroform	Detector Tubes	(H+D)	0-1 ppm	Level D, no respiratory protection required to be worn.
			>1 ppm	Withdraw from site or go to Level B protection.
Dust	Mini-RAM	(H + D)	<0.04 mg/m^3	Respirators not required.
			>0.04 mg/m^3	Level C respiratory protection required.
			>0.25 mg/m^3	Stop work. Call radiation protection technician (RPT). Trigger level based on annual committed effective dose equivalent of 1.0 Rem/yr. assuming worst-case soil level of 3590 pCi/g plutonium.
Radiological Hazard	**Instrument**	**Frequency**	**Action Limit**	**Action**
Whole Body Dosimeter	Thermoluminscent Dosimeter (TLD) Badge	(C)		Normal TLD badge use.
Alpha Radiation	Ludlum Model 12-1A (or as appropriate)	(H + D)	> 250 counts per minute	Don level C PPE and notify HSL.

(H + D) is hourly plus more frequent monitoring during activities which disturb the soil.
(C) is continuous monitoring.
(H) is hourly monitoring.
(D) is daily monitoring.

TABLE B 6-2

PERMISSIBLE HEAT EXPOSURE THRESHOLD LIMIT VALUES ADAPTED FROM THE ACGIH 1992-1993 TLVs

Level of PPE	Work-Rest Regimen each hour	Work Load in WBGT[a]					
		Light[b]		Moderate[c]		Heavy[d]	
		°C	°F	°C	°F	°C	°F
Summer Work Uniform	Continuous Work	30.0	86	26.7	80	25.0	77
	75% Work / 25% Rest	30.6	87	28.0	82	25.9	78
	50% Work / 50% Rest	31.4	89	29.4	85	27.9	82
	25% Work / 75% Rest	32.2	90	31.1	88	30.0	86
D (Cotton Coveralls)	Continuous Work	28.0	82	24.7	77	23.0	73
	75% Work / 25% Rest	28.6	84	26.0	79	23.9	75
	50% Work / 50% Rest	29.4	85	27.4	81	25.9	77
	25% Work / 75% Rest	30.2	87	29.1	84	28	82
C (Water barrier, permeable)	Continuous Work	24.0	75	20.7	69	19.0	66
	25% Work / 25% Rest	24.6	76	22.0	72	19.9	68
	50% Work / 50% Rest	25.4	78	23.4	74	21.9	71
	25% Work / 75% Rest	26.2	79	25.1	77	24.0	75
B (Water barrier, impermeable)	Continuous Work	20.0	68	16.7	62	15.0	59
	75% Work / 25% Rest	20.6	69	18.0	64	15.9	61
	50% Work / 50% Rest	21.4	71	19.0	66	17.9	64
	25% Work / 75% Rest	22.2	72	21.0	70	20.0	68

(a) For unacclimatized workers, the permissible heat exposure TLV should be reduced by 2.5% °C.
(b) Light = sitting or standing to control machinery, preforming light hand or arm work.
(c) Moderate = walking about with moderate lifting or pushing.
(d) Heavy = pick and shovel work, hand auguring.

TABLE B 7-1

EXPOSURE SYMPTOMS AND ACTION REQUIRED

Condition/ Agent	Warning Symptoms	Action Required
Pre heat stress	Headache Pulse over 110 bpm	Check pulse. Rest and drink cool fluids until heart rate is below 110. Increase frequency of breaks and increase cool water intake.
Heat cramps	Cramps Exhaustion Dizziness	Move to cool place. Give cool fluids to drink. Massage cramping area. Withdraw from field work for minimum of 1 day.
Heat exhaustion	Rapid breathing Weak pulse Cold, clammy skin Heavy perspiration	Move to cool place. Make patient rest. Remove PPE. Give cool fluids to drink. Withdraw from field work for a minimum of 2 days.
Heat stroke	Pulse over 110 bpm Hot, dry skin Dilated pupils disorientation	Remove PPE. Cool rapidly using cool **NOT COLD** water. Treat for shock. **TRANSPORT TO HOSPITAL. LIFE THREATENING:** Doctor must provide written permission for return to work.
Frostbite	Gray, blanched skin Numbness	If medical attention is not available, the affected area should be carefully warmed. If warming is done, it should be done by immersing the affected area in water that is approximately body temp. (100-105°F). Do not allow the affected body parts to touch the sides or bottom of the container (bath tub). Do not place pressure on the affected area. The presence of pain is an indicator of successful rewarming. Wrap rewarmed area in gauze and transport to hospital for treatment.
Hypothermia	Shivering Body temperature below 95.6°F	**SEEK MEDIAL ATTENTION IMMEDIATELY,** if not readily available, remove wet clothing, dry the person, keep victim at rest, slowly warm core without warming legs, give warm (not hot) liquids if person is conscious, transport to hospital as soon as possible.
Radiation	No exposure symptoms expected	Trace quantities of americium, plutonium, tritium, and uranium may be present as soil and groundwater contaminants. Based on maximum soil contaminant concentrations found in nearby areas, resuspended dust is not expected to exceed regulatory limits for airborne radiation. See Sections B 5 and B 6 for action limits
Chemicals	No symptoms expected	Airborne contaminant concentrations are expected to remain well below occupational exposure limits. No exposure symptoms are therefore expected. Exposures above the PEL may produce headache, nausea, dizziness, irritation of eyes, nose and lungs. See Section B 5 and B 6 if action levels are exceeded.

TABLE B 8-1

PERSONAL PROTECTIVE EQUIPMENT

Item	Task	Comment
Respiratory Protection	1, 2 or 3	Full-face air purifying respirators (manufacturers: MSA or North) when action levels or conditions dictate the use. Initial drilling/sampling (Task 1), construction (Task 2), and SVE operation (Task 3) will be done using respirators in Level C PPE. PPE can be downgraded to Level D (no respirator) if action levels are not exceeded. If monitoring results indicate that organic vapors exceed 10 ppm and/or the detector tubes indicate a concentration of 1 ppm carbon tetrachloride and/or PCE, withdraw from site or go to level B protection.
Respirator Cartridges	1, 2, or 3	Use organic vapor and high efficiency particulate filter cartridges (OV/HEPA) when Level C respirator required. Cartridges to use: North = 7137 and MSA = GMA-H.
Boots, safety (leather) steel toe, steel shank	1, 2, or 3	OSHA requirement
Overboots, latex	1	To prevent potential for direct contact with radiological and chemical wastes.
Gloves (leather) to be disposed of as they are contaminated	1, 2, or 3	To prevent potential for direct contact with radiological and chemical wastes.
Outer gloves (Nitrile, ≥ 11 mil)	1, 2, or 3	To prevent potential for direct contact with radiological and chemical wastes. May be worn alone for Tasks 2 and 3, as needed. At the discretion of the SHSC, these gloves may be omitted and the thinner nitrile gloves may be substituted.
Inner gloves (Nitrile, 4 mil)	1, 2 or 3	To provide added protection. These gloves must be changes as soon as they become torn, wet, or grossly contaminated by soils.
Coveralls (cotton or Tyvek)	1, 2 (or 3)	Potential for radiological contact during SVE is considered to be low. To protect against potential contact, disposable clothing will be worn during Tasks 1. The need for Tyvek during Task 3 will be determined on the basis of monitoring by the SHSC.
Eye wash	1, 2, and 3	Eye wash solution shall be available at SVE test location to perform initial flushing if necessary. Can transport to RFP medical clinic in immediate vicinity for remainder of 15 minute flushing or further first aid/medical attention if needed.
Ear Plugs or Muffs, NRR ≥ 20 dB	1, 2 or 3	To provide hearing protection as required by OSHA. Will be worn as noise monitoring dictates.
Safety Glasses	1, 2, and 3	Safety glasses with side shields to comply with American National Standards Institute (ANSI) Z87.1.
First Aid Kit	1, 2, and 3	Contains antiseptic spray, sterile eye wash, 1" x 5-yd. roller bandage, 1½" x 2" gauze pads, 1½" x 5-yd. spool of tape, aspirin, clean wipes, ice pack, ammonia inhalants, tweezers kit, triangular bandage, plastic bandage, compress, finger bandages, knuckle bandages, surgical gloves, CPR faceshield, bloodborne pathogens control kit and first-aid book. The content of first aid kit may be changed according to the determination of the W-C Occupational Physician.

TABLE B 8-2

REQUIRED LEVELS OF PPE

Level	Required PPE
D	Work Coveralls, safety glasses with side shield, steel toed safety boots The following will be worn as needed: ear plugs, inner gloves, outer gloves, leather gloves, hard hat
Modified D	Tyvek Coveralls, safety glasses with side shield, inner gloves, outer gloves, steel toed safety boots, boot covers, full-face respirator with cartridges, ready to don The following will be worn as needed: ear plugs, leather gloves, hard hat
C	Tyvek Coveralls, safety glasses with side shield, inner gloves, outer gloves, steel toed safety boots, boot covers, full-face respirator with cartridges, donned The following will be worn as needed: ear plugs, leather gloves, hard hat
B	Saranex Coveralls, safety glasses with side shield, inner gloves, outer gloves, steel toed safety boots, boot covers, supplied air respirator, donned The following will be worn as needed: ear plugs, leather gloves, hard hat

TABLE B 13-1

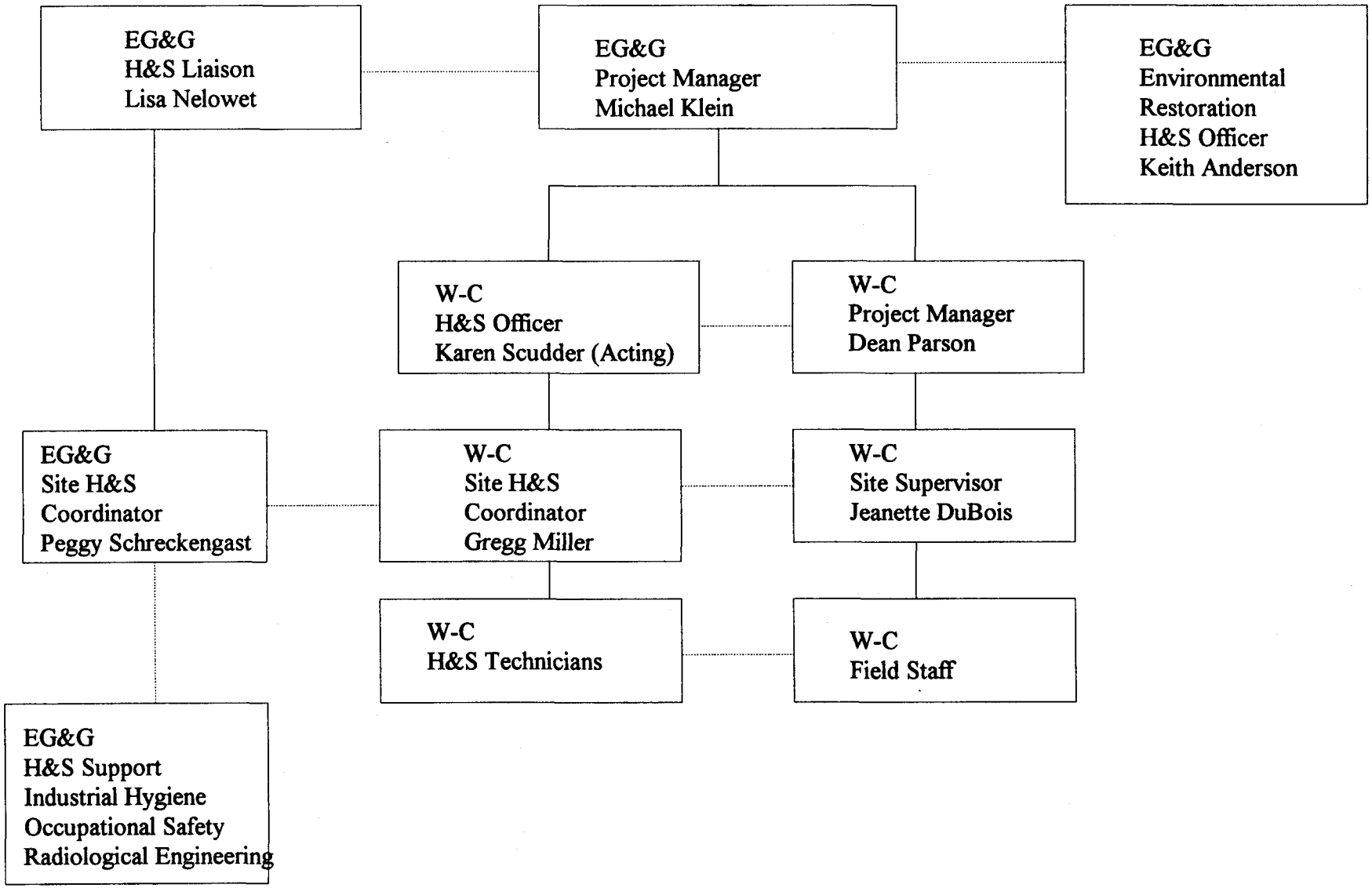
PROJECT PHONE LIST

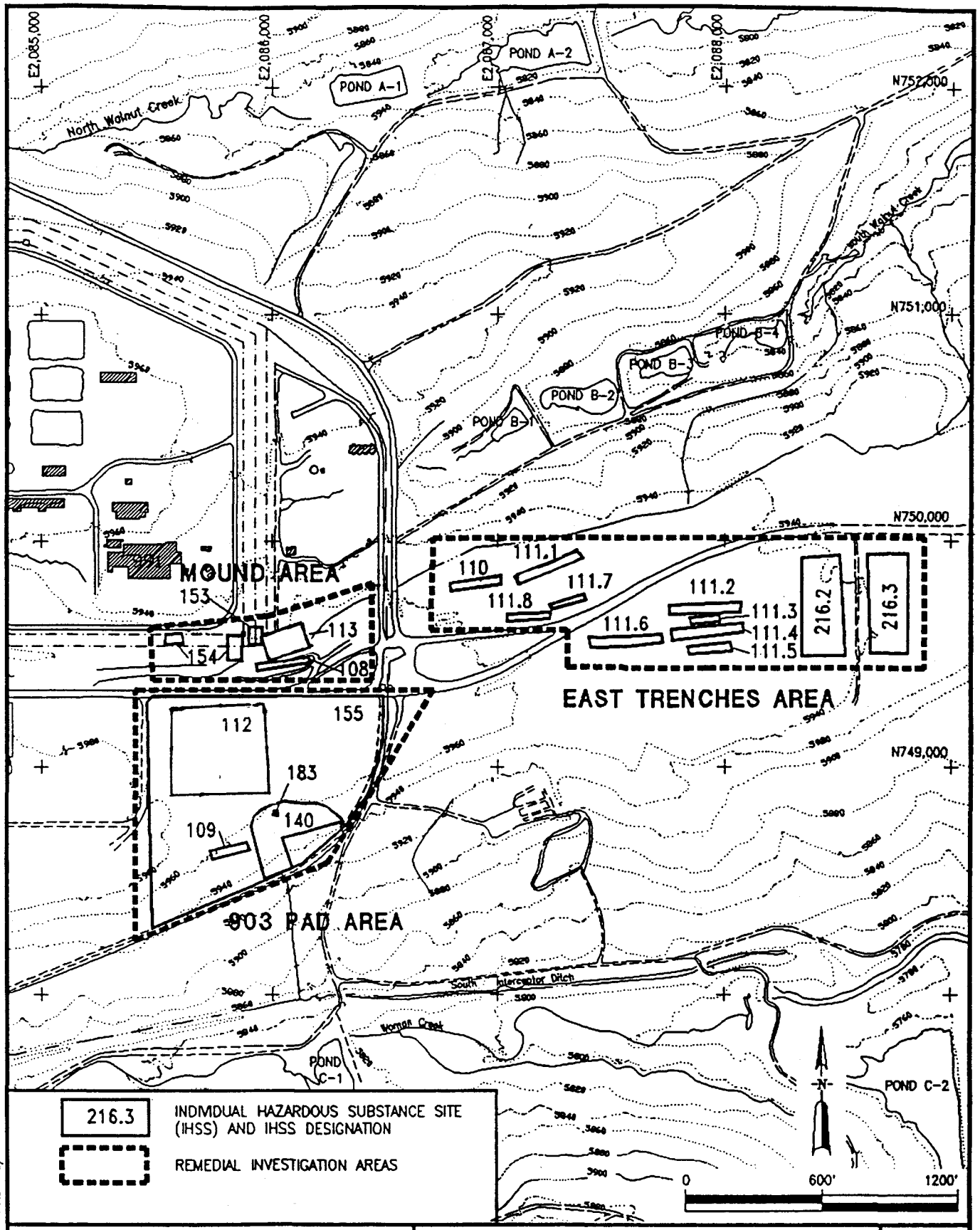
NAME	TITLE	WORK NUMBER	PAGER NUMBER	HOME NUMBER
Michael Klein	EG&G Project Manager	966-6950	966-4000 #7458	321-9466
Lisa Nelowet	EG&G Health and Safety Liaison	966-5810		
Peggy Schreckengast	EG&G Health and Safety Coordinator	966-6790	966-4000 #3059	
Keith Anderson	EG&G ER Health and Safety Officer	966-6979	966-4000 #5142	
Rick Gentry	EG&G Radiation Engineering Representative	966-8349	966-4000 #5390	
FJ Furman	EG&G Occupational Health Director	966-2895	966-4000 #2356	
Dean Parson	W-C Project Manager	740-2700	461-9939	932-1865
Jerry Andersen	W-C CHSO	(907)561-1020		
Karen Scudder	Acting W-C HSO	740-3837	760-1814	933-4363
Gregg Miller	W-C SHSC	966-8022	280-4610	699-0818
Barry O'Melia	W-C Task Manager	740-2700	461-9645	932-2293
Michael May	Alternate W-C Shift Manager	740-2700		470-8553
Jeanette DuBois	W-C Site Manager	740-2700/966-8022	851-3847	799-0854
Bill Fronczak	W-C Shift Manager	740-2700/966-8022	760-4552	530-5295
Nan Elzinga	W-C Shift Manager	740-2700/966-8022		499-6042
Nick Gomez	W-C Shift Manager	740-2700/966-8022		469-8125
Kent Trimbach	W-C HST	740-2700/966-8022		469-6483
Doug Schroer	W-C HST	740-2700/966-8022		745-1401
Tracy Hines	W-C HST	740-2700/966-8022		
Michael Ryan	W-C Sample Technician	966-8022		425-1195
Rock Powell	W-C Data Technician	740-2700/966-8022		986-6457
Bob Lahn	W-C Asst. SHSC	740-2700/966-8022	760-7599	466-3547
Kathleen Fischer	W-C Quality Assurance	740-2700/966-8022	280-4606	979-3034

FIGURES

FIGURE B 2-1

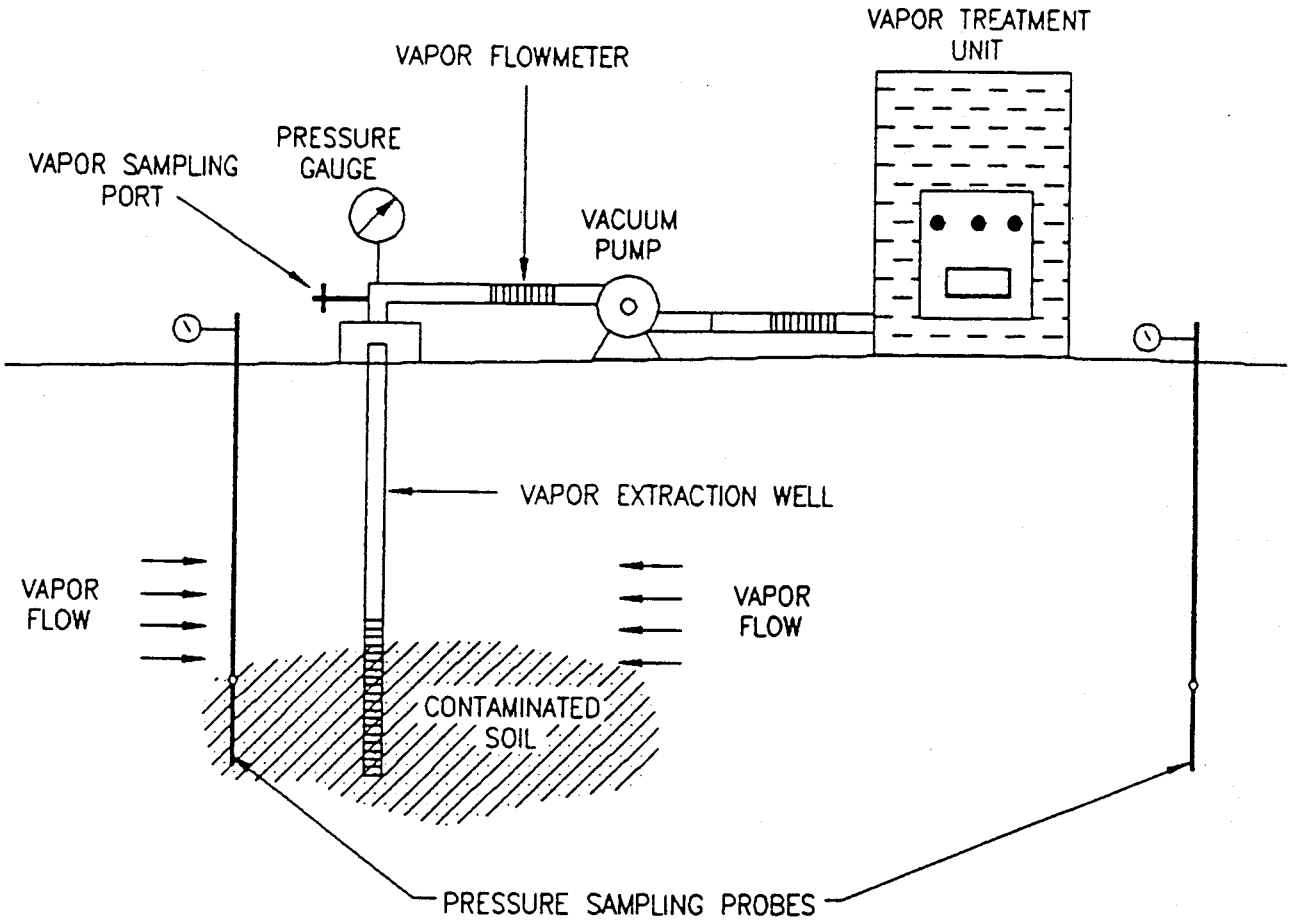
Project Organization





R37081.MBCW-102792/600

U.S. DEPARTMENT OF ENERGY Rocky Flats Plant Golden, Colorado	PROPOSED SOIL VAPOR EXTRACTION PILOT TEST SITES OPERABLE UNIT NO. 2	FIGURE B 3-1



U.S. DEPARTMENT OF ENERGY Rocky Flats Plant Golden, Colorado	SCHEMATIC DIAGRAM OF TYPICAL SINGLE WELL VENT SYSTEM	FIGURE B4-1

r37082.pj-090392

APPENDIX B 1

ROUTES TO HOSPITAL

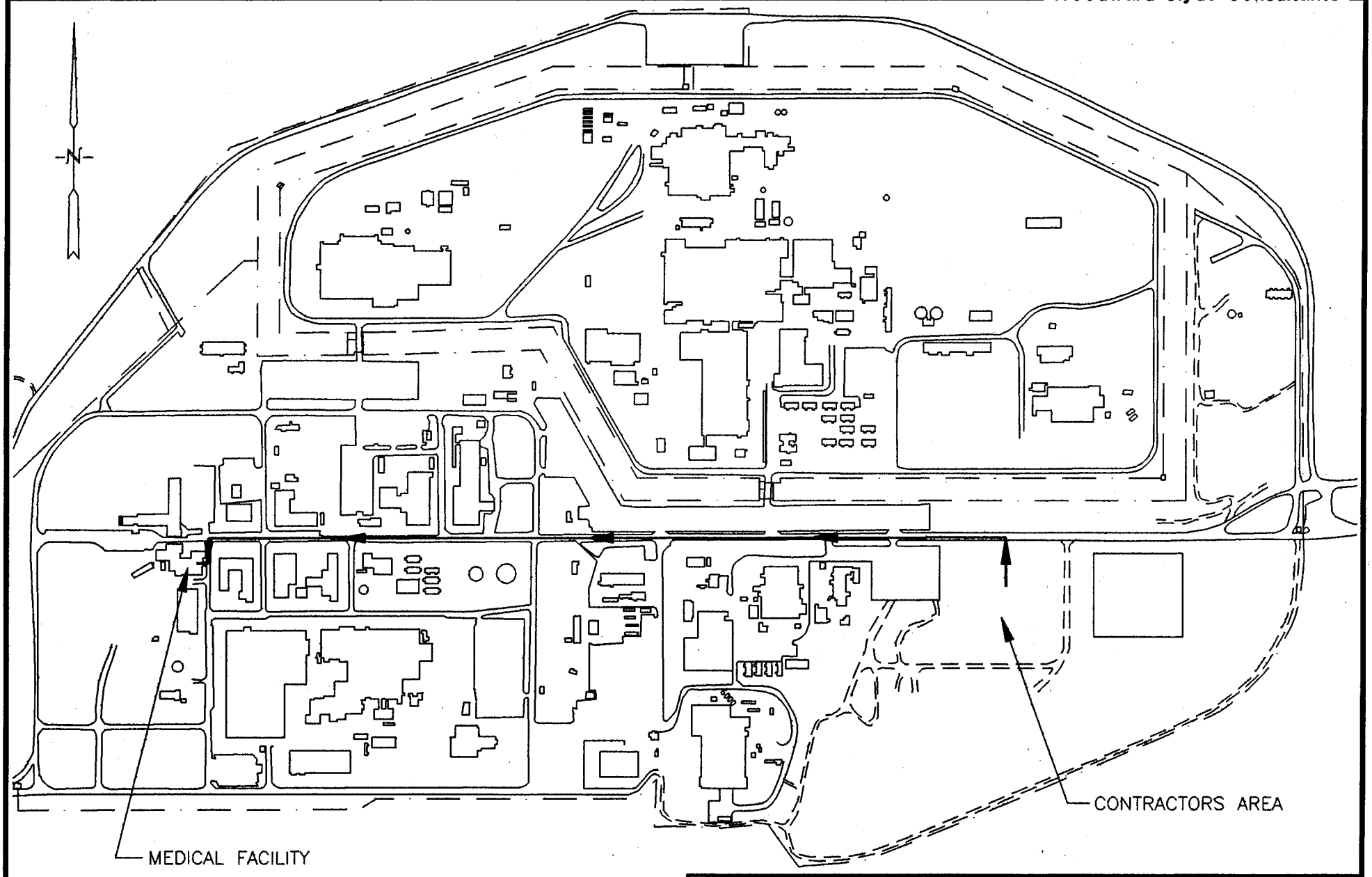
Directions to the On-Site Clinic: 2911

From the Contractor's trailer compounds, take a northbound street to Central Avenue and turn left onto Central Avenue: Building 122 will be on the left side and slightly west of the guard building on the right after approximately 1.25 miles. See the map on the next page.

Directions to the hospital: Avista Hospital 673-1000

From the contractor's compound, go north to Central Avenue and turn right onto Central Avenue. Continue east to the east gate, turn north. Continue north on McCaslin to near the intersection with Highway 36. Turn east on Dillon Road and continue to South 88th Street, turn south. Turn right on Health Park Drive until it ends. The hospital is located at 100 Health Park Drive. See the map which is included in this section.

Woodward-Clyde Consultants



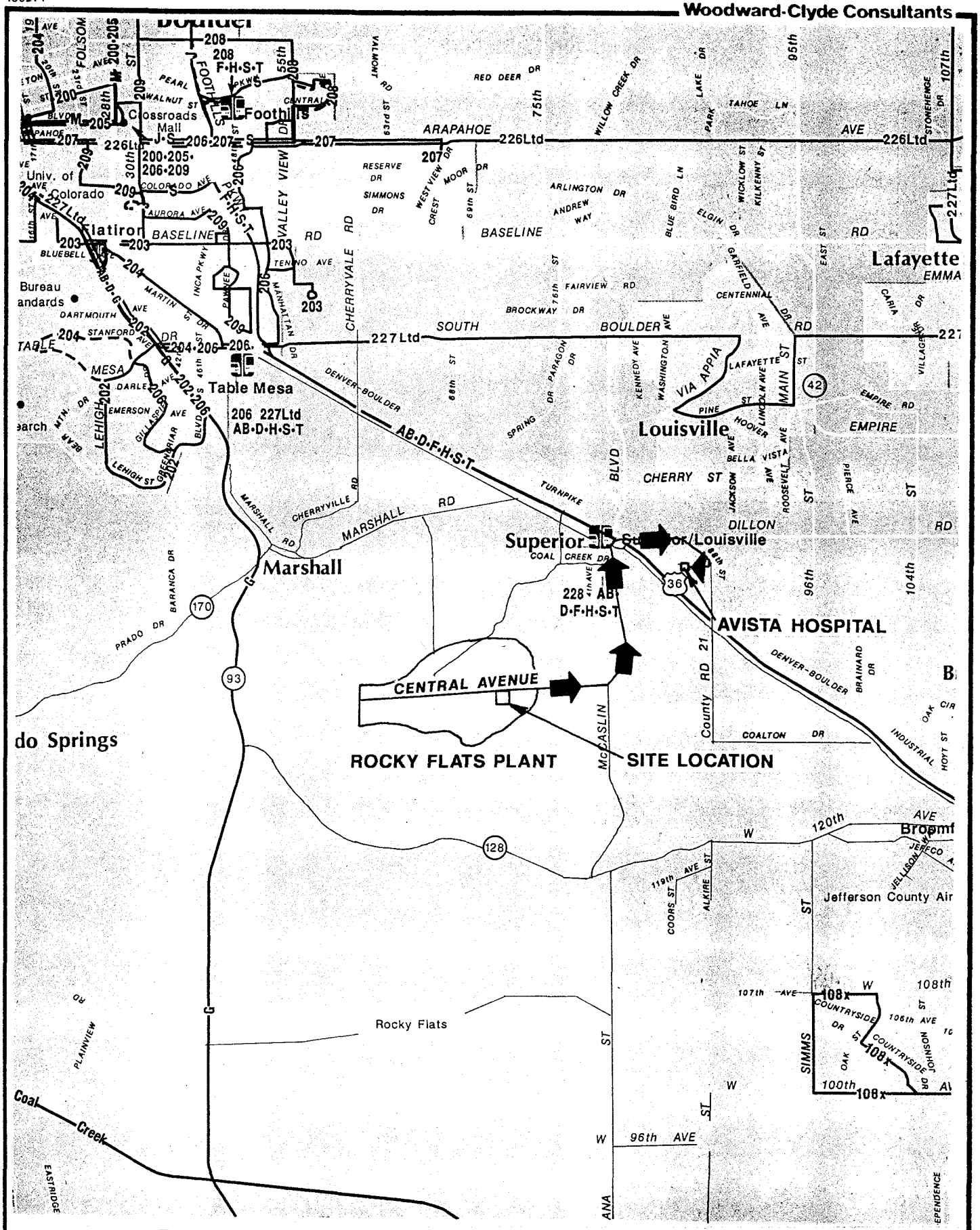
Job No. :	4050-310
Prepared by :	K.S.S.
Date :	2/10/94

MEDICAL FACILITY MAP

4050MED

150271

Woodward-Clyde Consultants



Job No. : 4045-310	ROUTE TO AVISTA HOSPITAL
Prepared by : K.S.S.	
Date : 2/9/94	

APPENDIX B 2

WOODWARD-CLYDE'S APPLICABLE OPERATING PROCEDURES

OPERATING PROCEDURE NO. HS-101

101.0 HAZARD COMMUNICATION PROGRAM

101.1 PURPOSE

Woodward-Clyde (W-C) is committed to informing employees of hazardous substances present in their places of work in accordance with the Occupational Health and Safety Administration (OSHA) Hazard Communication (HAZCOM) requirements, Title 29 Code of Federal Regulations (CFR) 1910.120 and 1926.59. This program applies to W-C work operations where employees may be exposed to hazardous substances.

Under the HAZCOM program, employees will be informed of the contents of the HAZCOM regulations, the hazardous properties of chemicals with which they work, safe handling procedures, and measures to take to protect themselves from these chemicals.

101.2 MATERIAL SAFETY DATA SHEETS (MSDS)/CHEMICAL HAZARD INFORMATION

MSDS provide specific information on the chemicals to which workers may be exposed. The MSDS should be a fully completed OSHA Form 174 or equivalent. Every effort will be made to obtain all pertinent MSDS or similar chemical hazard information whenever chemical exposure of W-C employees is possible.

The Health and Safety Officer is responsible for acquiring and updating MSDS for chemicals stored in buildings/offices. On field sites, MSDS for chemicals used by other firms will be available for examination. For hazardous waste site activities, chemical hazard information on the site contaminants will be provided in the Health and Safety Plan, while any chemicals brought on to the site need MSDS.

101.3 LABELS AND OTHER FORMS OF WARNING

Hazardous chemicals used will be properly labeled. Original labels will list the chemical identity, appropriate hazard warnings, and the name and address of the manufacturer. Referral will be

All HAZCOM training will be documented by a sign-in sheet recording each employee's attendance, the date, and the training topics covered. This sign-in sheet will be retained in the Project File. Such training can be performed by any of the following individuals:

- Health and Safety Coordinator
- Site Safety Officer
- Health and Safety Officer
- Corporate Health and Safety Officer

The implementation of the Hazard Communication Program will be under the general direction of a Certified Industrial Hygienist.

101.5 PROTECTIVE MEASURES

The use of chemical splash goggles, gloves, protective clothing, boots, and possibly respiratory protection may be required. If respiratory protection is used, it must be in full compliance with the OSHA standards under Title 29 CFR 1910.134 and Title 29 CFR 1926.103. All personal protective equipment used will be in accordance with Subpart I of Title 29 CFR 1910 and Subpart E of Title 29 CFR 1926. Any emergencies or problems involving hazardous chemicals will be reported to the Project Manager, the Health and Safety Officer and a Corporate Health and Safety Officer.

OPERATING PROCEDURE NO. HS-102

102.0 INCIDENT REPORTS

102.1 PURPOSE

All health and safety incidents shall be reported to Woodward-Clyde (W-C) management and health and safety staff. The prompt investigation and reporting of incidents will reduce the risk of future incidents, better protect W-C employees, and reduce W-C liability.

102.2 DEFINITIONS

A health and safety incident is any event listed below:

- Illness resulting from chemical exposure or suspected chemical exposure.
- Physical injury, including both those that do and do not require medical attention to W-C employees or W-C subcontractors.
- Fire, explosions, and flashes resulting from activities performed by W-C and its subcontractors.
- Property damage resulting from activities performed by W-C and its subcontractors.
- Vehicular accidents occurring on-site, while travelling to and from client locations, or with any company-owned vehicle.
- Infractions of safety rules and requirements.
- Unexpected chemical exposures.
- Complaints from the public regarding W-C field operations.

102.3 REPORTING PROCEDURES

102.3.1 Reporting Format

Incident reports shall be prepared by completing Form HS-102. This form may be obtained from any W-C Health and Safety Officer (HSO) and is attached to this operating procedure.

FORM HS-102

W-C HEALTH AND SAFETY INCIDENT REPORT

Project Name: _____

Project Number: _____

Date of Incident: _____

Time of Incident: _____

Location: _____

_____

TYPE OF INCIDENT (Check all applicable items)

☐ Illness

☐ Injury

☐ Property Damage

☐ Health & Safety Infraction

☐ Other (describe) _____

☐ Fire, explosion, flash

☐ Unexpected exposure

☐ Vehicular Accident

DESCRIPTION OF INCIDENT (Describe what happened and possible cause. Identify individual involved, witnesses, and their affiliations; and describe emergency or corrective action taken. Attach additional sheets, drawings, or photographs as needed.)

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Reporter:

_____ Print Name

_____ Signature

_____ Date

Reporter must deliver this report to the Operating Unit Health & Safety Officer within 24 hours of the reported incident for medical treatment cases and within five days for other incidents.

Reviewed by: _____ Operating Unit Health & Safety Officer

_____ Date

Distribution by HSO:

- WCGI Corporate Health and Safety Manager
- Corporate Health and Safety Officer
- Project Manager
- Personnel Office (medical treatment cases only)

OPERATING PROCEDURES NO. HS-201

201.0 HEAT STRESS

201.1 PURPOSE

The purpose of this Operating Procedure is to provide general information on heat stress and the methods that can be utilized to prevent or minimize the occurrence of heat stress.

Adverse climatic conditions are important considerations in planning and conducting site operations. Ambient temperature effects can include physical discomfort, reduced efficiency, personal injury, and increased accident probability. Heat stress is of particular concern while wearing impermeable protective garments, since these garments inhibit evaporative body cooling.

201.2 TYPES OF HEAT STRESS

Heat stress is the combination of environmental and physical work factors that constitute the total heat load imposed on the body. The environmental factors of heat stress are the air temperature, radiant heat exchange, air movement, and water vapor pressure. Physical work contributes to the total heat stress of the job by producing metabolic heat in the body in proportion to the intensity of the work. The amount and type of clothing also affects heat stress.

Heat strain is the series of physiological responses to heat stress. When the strain is excessive for the exposed individual, a feeling of discomfort or distress may result, and, finally, a heat disorder may ensue. The severity of strain will depend not only on the magnitude of the prevailing stress, but also on the age, physical fitness, degree of acclimatization, and dehydration of the worker.

Heat disorder is a general term used to describe one or more of the heat-related disabilities or illnesses shown in Table 201-1.

201.3 METHODS OF CONTROLLING HEAT STRESS

The WBGT shall be compared to the TLV outlined by the American Conference of Governmental Industrial Hygienists (ACGIH) TLV guides, and a work-rest regiment can be established in accordance with the WBGT. Note that approximately 5°C must be subtracted from the TLVs listed for heat stress to compensate for the wearing of impermeable protective clothing.

201.6.2 Medical

In addition to the provisions of the Woodward-Clyde (W-C) medical surveillance program, on-site medical monitoring of personnel should be performed for projects where heat stress is a significant concern. Blood pressure, pulse, body temperature (oral), and body weight loss may be utilized.

Heart Rate: Count the radial pulse during a 30-second period as early as possible in the rest period. If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third. If the heart rate still exceeds 110 beats per minute at the next rest cycle, shorten the following work cycle by one-third.

Oral Temperature: Use a clinical thermometer or similar device to measure the oral temperature at the end of the work period (before drinking liquids). If the oral temperature exceeds 99.6°F (37.6°C), shorten the next work cycle by one-third without changing the rest period. If the oral temperature still exceeds 99.6°F (37.6°C) at the beginning of the next rest period, shorten the following work cycle by one-third.

Do not permit a worker to wear a semipermeable or impermeable garment if his/her oral temperature exceeds 100.6°F (38.1°C).

Body Water Loss: Measure body weight on a scale accurate to $\pm$0.25 pounds at the beginning and end of each work day (also at lunch break, if possible) to see if enough fluids are being taken to prevent dehydration. Weights should be taken while the employee wears similar clothing or, ideally, nude. The body water loss should not exceed 1.5 percent total body weight loss in a work day.

Physiological Monitoring: Initially, the frequency of physiological monitoring depends on the air temperature adjusted for solar radiation and the level of physical work. The length

TABLE 201-1
Classification, Medical Aspects, and Prevention of Heat Illness

Category and Clinical Features	Predisposing Factors	Underlying Physiological Disturbances	Treatment	Prevention
Temperature Regulation Heatstroke **Heatstroke**: (1) Hot, dry skin; usually red, mottled, or cyanotic; (2) rectal temperature 40.5°C (104°F) and over; (3) confusion, loss of consciousness, convulsions, rectal temperature continues to rise; fatal if treatment is delayed	(1) Sustained exertion in heat by unacclimatized workers; (2) lack of physical fitness and obesity; (3) recent alcohol intake; (4) dehydration; (5) individual susceptibility; and (6) chronic cardiovascular disease	Failure of the central drive for sweating (cause unknown) leading to loss of evaporative cooling and an uncontrolled accelerating rise in t_{re}; there may be partial rather then complete failure of sweating	Immediate and rapid cooling by immersion in chilled water with massage or by wrapping in wet sheet with vigorous fanning with cool dry air; avoid overcooling; treat shock if present	Medical screening of workers, selection based on health and physical fitness; acclimatization for 5-7 days by graded work and heat exposure; monitoring workers during sustained work in severe heat
Circulatory Hypostasis Heat Syncope Fainting while standing erect and immobile in heat	Lack of acclimatization	Pooling of blood in dilated vessels of skin and lower parts of body	Remove to cooler area; rest in recumbent position; recovery prompt and complete	Acclimatization; intermittent activity to assist venous return to heat
Water and or Salt Depletion (a) Heat Exhaustion (1) Fatigue, nausea, headache, giddiness; (2) skin clammy and moist; complexion pale, muddy, or hectic flush; (3) may faint on standing with rapid thready pulse and low blood pressure; (4) oral temperature normal or low, but rectal temperature usually elevated (37.5-38.5°C or 99.5-101.3°F); water restriction type: urine volume small, highly concentrated; salt restriction type; urine less concentrated chlorides less than 3 g/L	(1) Sustained exertion in heat; (2) lack of acclimatization; and (3) failure to replace water lost in sweat	(1) Dehydration from deficiency of water; (2) depletion of circulating blood volume; (3) circulatory strain from competing demands for blood flow to skin and to active muscles	Remove to cooler environment; rest in recumbent position; administer fluids by mouth; keep at rest until urine volume indicates that water balances have been restored	Acclimatize workers using a breaking-in schedule for 5-7 days; supplement dietary salt only during acclimatization; ample drinking water to be available at all times and to be taken frequently during work day
(b) Heat Cramps Painful spasms of muscles used during work (arms, legs, or abdominal); onset during or after work hours	(1) Heavy sweating during hot work; (2) drinking large volumes of water without replacing salt loss	Loss of body salt in sweat, water intake dilutes electrolytes; water enters muscles, causing spasm	Salted liquids by mouth or more prompt relief by IV infusion	Adequate salt intake with meals; for unacclimatized workers, supplement salt intake at meals.

OPERATING PROCEDURE NO. HS-202

202.0 COLD STRESS

202.1 PURPOSE

The purpose of this Operating Procedure is to provide information on cold stress and the procedures for preventing and dealing with cold stress. Adverse climatic conditions are important considerations in planning and conducting site operations. Ambient temperature effects can include physical discomfort, reduced efficiency, personal injury, and increased accident probability.

202.2 TYPES OF COLD STRESS EFFECTS

202.2.1 Frostbite

Local injury resulting from cold is included in the generic term frostbite. There are several degrees of damage. Frostbite can be categorized into:

- **Frost Nip or Initial Frostbite:** (1st degree frostbite) Characterized by blanching or whitening of skin.

- **Superficial Frostbite:** (2nd degree frostbite) Skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient. Blistering and peeling of the frozen skin will follow exposure.

- **Deep Frostbite:** (3rd degree frostbite) Tissues are cold, pale, and solid; extremely serious injury with possible amputation of affected area.

Frostbite can occur without hypothermia when the extremities do not receive sufficient heat. The toes, fingers, cheeks, and ears are the most commonly affected. Frostbite occurs when there is freezing of the fluids around the cells of the affected tissues. The first symptom of frostbite is an uncomfortable sensation of coldness, followed by numbness. There may be tingling, stinging, or cramping. Contact by the skin with tools or other metal objects below 20°F (-7°C) may result in contact frostbite.

applying external heat (such as a pre-warmed sleeping bag, electric blanket, or body-heat from other workers) and follow-up medical attention.

202.4 EXPOSURE LIMITS

The American Conference of Governmental Industrial Hygienists (ACGIH) has adopted Threshold Limit Values (TLVs) for cold stress. These limits set maximum work periods based on a combination of wind and temperature.

202.5 REFERENCES

American Conference of Governmental Industrial Hygienists, Documentation of Threshold Limit Values, 1984

EPA, Standard Operating Safety Guides, 1992, pages 95-100.

TABLE 202-1

Windchill Index[1]

Wind speed in mph	ACTUAL THERMOMETER READING (°F)									
	50	40	30	20	10	0	-10	-20	-30	-40
	EQUIVALENT TEMPERATURE (F)									
calm	50	40	30	20	10	0	-10	-20	-30	-40
5	48	37	27	16	6	-5	-15	-26	-36	-47
10	40	28	16	4	-9	-21	-33	-46	-58	-70
15	36	22	9	-5	-18	-36	-45	-58	-72	-85
20	32	18	4	-10	-25	-39	-53	-67	-82	-96
25	30	16	0	-15	-29	-44	-59	-74	-88	-104
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109
35	27	11	-4	-20	-35	-49	-67	-82	-98	-113
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116
Over 40 mph (little added effect)	Little Danger (for properly clothed person)				Increasing Danger (Danger from freezing of exposed flesh)			Great Danger		

[1] Source: Fundamentals of Industrial Hygiene, Third Edition. Plog, B.A., Benjamin, G.S., Kerwin, M.A., National Safety Council, 1988.

OPERATING PROCEDURE NO. HS-203

203.0 SAFETY GUIDELINES FOR DRILLING INTO SOIL AND ROCKS

203.1 PURPOSE

The purpose of this Operating Procedure (OP) is to provide an overview for working safely around drilling operations with truck-mounted and other engine-powered drill rigs. The procedure addresses off-road movement of drill rigs, overhead and buried utilities, use of augers, rotary and core drilling, and other drilling operations and activities.

203.2 APPLICATION

The guidelines shall be applied in Woodward-Clyde (W-C) projects in which truck-mounted, or other engine-powered, drill rigs are used. The guidelines are applicable to W-C employees and W-C owned rigs. For drill rigs operated by contractors, the primary responsibility for drilling safety is with the drilling contractor.

203.3 RESPONSIBILITY AND AUTHORITY

Drill rig safety and maintenance is the responsibility of the drill rig operator. W-C employees are responsible for their own safety including recognizing and avoiding drill rig hazards. W-C employees that observe a drill rig condition believed to be unsafe, shall advise the drill rig operator of the unsafe condition.

203.4 SAFETY GUIDELINES

203.4.1 Movement of Drill Rigs

Before moving a rig, the operator must do the following:

1. To the extent practical, walk the planned route of travel and inspect it for depressions, gullies, ruts, and other obstacles.

203.5 BURIED AND OVERHEAD UTILITIES

The location of overhead and buried utility lines must be determined before drilling begins, and the locations should be noted on boring plans or assignment sheets.

When overhead power lines are close by, the drill rig mast should not be raised unless the distance between the rig and the nearest power line is at least 20 feet or other distance as required by local ordinances, whichever is greater. The drill rig operator or assistant should walk completely around the rig to make sure that proper distance exists.

When the drill rig is positioned near an overhead line, the rig operator should be aware that hoist lines and power lines can be moved towards each other by wind. When necessary and approved by the Project Manager (PM) and the utility and/or powerlines may be shielded, shut down, or moved by the appropriate personnel.

203.6 CLEARING THE WORK AREA

Before a drill rig is positioned to drill, the area on which the rig is to be positioned should be cleared of removable obstacles and the rig should be leveled if sloped. The cleared/leveled area should be large enough to accommodate the rig and supplies.

203.7 SAFE USE OF AUGERS

Never place hands or fingers under the bottom of an auger flight or drill rods when hoisting the augers or rods over the top of another auger or rod in the ground or other hard surfaces, such as the drill rig platform.

Never allow feet to get under the auger or drill rod while they are being hoisted.

When the drill is rotating, stay clear of the drill string and other rotating components of the drill rig. Never reach behind or around a rotating auger for any reason.

Move auger cuttings away from the auger with a long-handled shovel or spade; never use hands or feet.

- Safety Shoes (shoes or boots with steel toes and shanks); and
- Gloves.

203.10.2 Other Gear

Items listed below should be worn when conditions warrant their use. Some of the conditions are listed after each item.

1. **Safety Goggles or Glasses:** Use when working within 25 feet of a drill rig or when using hand tools or chemicals that may create eye hazards.

2. **Safety Belts and Lifelines:** Safety belts and lifelines should be worn by all persons working on top of an elevated derrick beam. The lifeline should be secured at a position that will allow a person to fall no more than eight feet.

3. **Life Vests:** Use for work over water.

203.11 TRAFFIC SAFETY

Drilling in streets, parking lots or other areas of vehicular traffic requires definition of the work zones with cones, warning tape, etc. and compliance with local police requirements.

203.12 FIRE SAFETY

1. Fire extinguishers shall be kept on or near drill rigs for fighting small fires.

2. If methane is suspected in the area, a combustible gas instrument (CGI) shall be used to monitor the air near the borehole with all work to stop at 20 percent of the Lower Explosive Limit.

3. Work shall stop during lighting storms.

OPERATING PROCEDURE NO. HS-205

205.0 CONFINED SPACE ENTRY

205.1 PURPOSE

Entry into confined spaces always represents a potentially hazardous situation. Without proper planning, both entrants and rescuers may be at risk of death or injury. By following the approach outlined in this procedure, these risks can be minimized.

205.2 DEFINITIONS

Attendant: A person who is assigned as standby to monitor a confined space process or operation and to provide support and react as required.

Biological Hazards: Infectious agents presenting a risk or potential risk to the well-being of man, or other animals, either directly through infection or indirectly through disruption of the environment.

Blanking: Inserting a solid barrier across the open end of a pipe leading into or out of the confined space, and securing the barrier in such a way to prevent leakage of material into the confined space.

Confined Space: An enclosed area that has the following characteristics:

- its primary function is something other than human occupancy,
- has restricted entry and exits, and
- may contain potential or known hazards.

LEL/LFL and UEL/UFL: Acronyms for "Lower Explosive Limit"/"Lower Flammable Limit" and "Upper Explosive Limit"/"Upper Flammable Limit."

Lockout/Tagout: The placement of a lock or tag on the energy-isolating device in accordance with an established procedure, indicating that the energy-isolating device shall not be operated until removal of the lock or tag in accordance with an established procedure.

(The term "lockout/tagout" allows the use of a lockout device, a tag, or a combination of both.)

Non-Permit Confined Space (NPCS): A space which, by configuration, meets the definition of a confined space but which after evaluation is found to have little potential for generation of hazards or has hazards eliminated by engineering controls.

Oxygen Deficient Atmosphere: An atmosphere containing less than 19.5% oxygen by volume.

Oxygen Enriched Atmosphere: An atmosphere containing more than 23.5% oxygen by volume.

PEL: An acronym for "Permissible Exposure Limit" which is the allowable air contaminant level established by the U.S. Department of Labor, Occupational Safety and Health Administration.

Permit Required Confined Space (PRCS): A confined space which after evaluation has actual or potential hazards which have been determined to require written authorization for entry.

Qualified Person: A person who by reason of training, education and experience is knowledgeable in the operation to be performed and is competent to judge the hazards involved.

TLV: An acronym for "Threshold Limit Value".

7. Equipment. Provide, maintain and ensure the proper use of the equipment necessary for safe entry, including testing, monitoring, communication and personal protective equipment.

8. Rescue. Ensure that the procedures and equipment necessary to rescue entrants from permit spaces are implemented and provided.

9. Protection from External Hazards. Ensure that all pedestrian, vehicle or other barriers necessary to protect entrants from external hazards are provided.

10. Duty to Other Employers. Ensure that when W-C employs subcontractors, W-C provides the subcontractor with all available information on permit space hazards; on the OSHA Confined Space Standard; and on any other workplace hazards and emergency procedures of which the contractor needs to be aware.

205.5 CONFINED SPACE ENTRY PERMIT

A permit (Form HS-205) shall be used for all confined space entries. Permits must include the following:

1. The hazards of the permit space;

2. The measures for isolation of the permit space;

3. The measures, such as lockout/tagout equipment and procedures for purging, inverting, ventilating and flushing, used to remove or control potential hazards;

4. Acceptable environmental conditions, qualified with regard to the hazards identified in the permit space;

5. Testing and monitoring equipment and procedures to verify that acceptable environmental conditions are being maintained during entry;

205.6 TRAINING REQUIREMENTS AND DUTIES OF PERSONNEL

205.6.1 Entrants

The individuals entering the confined space must:

1. Know the hazards which may be faced during entry;

2. Recognize the signs and symptoms of exposure to a hazard;

3. Understand the consequences of exposure to a hazard;

4. Maintain contact with the attendant;

5. Notify the attendant when the entrants self-initiate evaluation of the permit space;

6. Be aware of the personal protective equipment, such as retrieval lines, respirators or clothing, needed for safe entry and exit;

7. Be provided with the necessary personal protective equipment;

8. Use the personal protective equipment properly;

9. Be aware of the external barriers needed to protect entrants from external hazards and of the proper use of those barriers; and

10. Exit the permit space, unless it is physically impossible to do so, when:

    - The attendant orders evacuation;
    - An automatic alarm is activated;
    - The authorized entrants perceive they are in danger.

- Warn unauthorized persons away from the space;

- Request the unauthorized persons to exit immediately if they have entered the permit space; and

- Inform the authorized entrants and any other persons designated by the employer that unauthorized persons have entered the permit space.

7. No one may enter into the permit space to attempt rescue of entrants unless he/she is trained as a rescuer, emergency procedures are followed, and back-up assistance has arrived.

205.6.3 The Person Authorizing Entry

Individuals authorizing or in change of entry must receive the appropriate training and be approved by the W-C Health and Safety Officer (HSO) to perform the assigned duties, as follows:

1. Determine that the entry permit contains the requisite information before authorizing or allowing entry;

2. Determine that the necessary procedures, practice, and equipment for safe entry are in effect before allowing entry;

3. Determine, at appropriate intervals, that entry operations remain consistent with the terms of the entry permit, and that acceptable entry conditions are present;

4. Authorize entry and terminate entry whenever acceptable entry conditions are not present;
5. Serve as authorized entrants or attendants for an entry if they have the proper training.

205.7 ATMOSPHERIC TESTING

Prior to entry, the atmosphere of a confined space must be tested:

Only rescuers trained in confined space rescue should attempt a rescue. The attendant generally should not attempt a rescue. If an emergency occurs, the attendant should summon assistance as rapidly as possible. A pre-arranged signal to summon assistance may be used. This could consist of a horn, flashing light, or other alarm device. Emergency communication devices must be clearly identified prior to entry. Rescue teams should practice confined space rescue at least once every 12 months. At least one member of the rescue team must maintain current first-aid and CPR certification.

Rescue teams brought in from the outside must be made aware of the hazards that they may confront in the specific confined space.

205.11 HAZWOPER SITE SAFETY AND HEALTH PLANNING PER TITLE 29 CFR 1910.120

Confined space entry permits and planning may be included as part of site safety and health plans. Such plans will require the normal Woodward-Clyde Health and Safety Plan approvals.

FORM HS-205
WOODWARD-CLYDE
CONFINED SPACE ENTRY PERMIT
(page 1 of 2)

Project Name/No. _____

Location of Confined Space _____

Purpose of Entry and Description of Work

Possible Hazards _____

Names of Authorized Entrants:

Names of Eligible Attendants:

Individuals to be In Charge:

Rescue Service Information:

Responding Team: _____

Address: _____

Phone No.: _____

Hazard Control Measures (e.g. Ventilation)
Complied? _____ (SSO must initial prior to entry)

List of Rescue Equipment Required on Site
Complied? _____ (SSO must initial prior to entry)

Communication Procedures and Equipment
Complied? _____ (SSO must initial prior to entry)

Personal Protective Equipment Required
Complied? _____ (SSO must initial prior to entry)

Lockout/Tagout Procedures Required
Complied? _____ (SSO must initial prior to entry)

Comments/Additional Information

OPERATING PROCEDURE NO. HS-211

211.0 BLOODBORNE PATHOGENS

211.1 BLOODBORNE PATHOGENS EXPOSURE CONTROL PLAN

The following Exposure Control Plan has been developed in accordance with the Occupational Safety and Health Administration (OSHA) Bloodborne Pathogens Standard, Title 29 Code of Federal Regulations (CFR) 1910.1030. The goal is to reduce the risk of disease in employees potentially exposed to bloodborne pathogens.

211.2 EXPOSURE ROUTES

The transmission of infectious agents such as bacteria and virus's may occur through direct contact, airborne, and vector routes of exposure. Direct contact is an important route of exposure for bloodborne pathogens due to needlestick injuries, puncture injuries, contact with abraded skin, or contact with areas such as the eyes, without skin protection. While very few organisms can enter the body through normal intact skin, direct contact with blood is to be avoided.

The airborne route of exposure is significant for common viral diseases including colds, flu, mumps, and chicken pox, but is not typically an exposure route for pathogens such as Human Immodeficiency Virus (HIV) or Hepatitis B Virus (HBV) infections.

Vector borne diseases are those transferred to humans by insects or animals and include lyme disease, malaria, plague, and rabies. (Further information on tick-borne diseases may be seen in HS-213.) Vectors are not considered a significant route of exposure for HIV or HBV.

Woodward-Clyde (W-C) employees that may have potential exposure to blood or to biohazard waste include Site Safety Officers (SSO) during first aid procedures and field staff on projects involving medical or other infectious waste. The W-C job classification and associated tasks for these categories are as follows:

- Removal of blood contaminated clothing

- Clean-up of blood on tools or equipment

The controls will be checked and maintained on a regular schedule. The schedule for reviewing the effectiveness of the controls is as follows:

- Controls and procedures will be checked daily before start of any field activities.

- Maintaining and enforcing these controls will be the responsibility of the Site Health and Safety Officer.

Handwashing facilities must be readily accessible after incurring exposure. If handwashing facilities are not feasible, the SSO is required to provide either an antiseptic cleanser in conjunction with a clean cloth/paper towels or antiseptic towelettes. If these alternatives are used, then the hands are to be washed with soap and running water as soon as feasible.

If employees incur exposure to their skin or mucous membranes then those areas shall be washed or flushed with water, as appropriate, as soon as feasible following contact.

211.5 CONTAINERS

Contaminated cutting materials, (i.e., knife, scissors) that are re-usable are to be placed immediately, or as soon as possible after use, into a separate container. These containers must be puncture resistant, labeled with a biohazard label, and be leakproof.

Containers for biohazard waste (used bandages, used gloves, etc.) will be located in the same area as the first aid equipment, and will be the responsibility of the SSO for proper disposal. Disposal will be arranged as soon as possible after use. These containers must be labeled with a biohazard label, and be leakproof

211.6 WORK AREA RESTRICTIONS

Workers are not to eat, drink, or smoke in areas with potential exposure to infectious materials.

All personal protective equipment will be cleaned, laundered, and disposed of by the employer at no cost to employees.

Any clothing which is penetrated by blood shall be removed immediately or as soon as feasible. PPE will be removed prior to leaving the work area.

Gloves shall be worn where it is reasonably anticipated that employees will have had contact with blood or other potentially infectious materials. Gloves will be available from the first aid kit.

Disposable gloves used during first aid and/or emergency procedures are not to be washed or decontaminated for re-use and are to be replaced as soon as practical when they become contaminated or as soon as feasible if they are torn, punctured, or when their ability to function as a barrier is compromised. Utility gloves may be decontaminated for re-use provided that the integrity of the glove is not compromised. Utility gloves will be discarded if they are cracked, peeling, torn, punctured, or exhibit other signs of deterioration or when their ability to function as a barrier is compromised.

Respirators in combination with eye protection devices, such as goggles or glasses with solid side shield, or chin length face shields, are required to be worn whenever splashes, spray, splatter, or droplets of blood or other potentially infectious materials may be generated.

Tyvek coverall (coated or uncoated), should be worn if the potential exists for blood to splash onto the first aid responders clothing.
Any PPE, soil, or small equipment that has blood on it shall be placed in a lined container and labeled. The SSO shall contact the HSO for further disposal information.

211.10 LAUNDRY PROCEDURES

Laundry contaminated with blood or other potentially infectious materials will be handled as little as possible. Such laundry will be placed in appropriately marked bags at the location where it was used. The HSO will then be notified for further instructions.

- If possible, the identification of the source individual and, if possible, the status of the source individual. The blood of the source individual will be tested (after consent is obtained) for HIV/HBV infectivity.

- Results of testing of the source individual will be made available to the exposed employee with the exposed employee informed about the applicable laws and regulations concerning disclosure of the identity and infectivity of the source individual.

- The employee will be offered the option of having their blood collected for testing of the employee's HIV/HBV serological status. The blood sample will be preserved for up to 90 days to allow the employee to decide if the blood should be tested for HIV serological status. However, if the employee decides prior to that time that testing will or will not be conducted then the appropriate action can be taken and the blood sample discarded.

- The employee will be offered post-exposure prophylaxis in accordance with the current recommendations of the U.S. Public Health Service.

- The employee will be given appropriate counseling concerning precautions to take during the period after the exposure incident. The employee will also be given information on what potential illnesses to be alert for and to report any related experiences to appropriate personnel.

- The HSO has been designated to assure that the policy outlined here is effectively carried out as well as to maintain records related to this policy.

211.13 INTERACTION WITH HEALTH CARE PROFESSIONALS

A written opinion shall be obtained from the health care professional who evaluates employees for each W-C office. Written opinions will be obtained in the following instances:

1) When the employee is sent to obtain the Hepatitis B vaccine.

211.15 RECORDKEEPING

All records required by the OSHA standard will be maintained by the HSO.

All employees will receive refresher training every 12 months. (Note that this training is to be conducted within one year of the employee's previous training.)

The outline for the training material is located in each office and also with the WCGI Health and Safety Office in Philadelphia, Pennsylvania.

FORM HS 211-1

TO SECTION 1910.1030
HEPATITUS B VACCINE DECLINATION (MANDATORY)

I understand that due to my occupational exposure to blood or other potentially infectious materials I may be at risk of acquiring Hepatitis B virus (HBV) infection. I have been given the opportunity to be vaccinated with Hepatitis B vaccine at no charge to myself. However, I decline Hepatitis B vaccination at this time. I understand that by declining this vaccine, I continue to be at risk of acquiring Hepatitis B, a serious disease. If in the future I continue to have occupational exposure to blood or other potentially infectious materials and I want to be vaccinated with Hepatitis B vaccine, I can receive the vaccination series at no charge to me.

Name: _____ _____
Employee Signature Date

Print: _____
Employee Name

Name: _____ _____
Health and Safety Officer Signature Date

Print: _____
Health and Safety Officer Name

OPERATING PROCEDURE NO. HS-212

212.0 NOISE/HEARING CONSERVATION

212.1 PURPOSE

The purpose of this Operating Procedure (OP) is to establish Woodward-Clyde (W-C) procedures and responsibilities for the administration of a hearing conservation program. A proper hearing conservation program will reduce the risk of occupationally induced hearing loss and provide education and guidance for the prevention of "lifestyle" induced hearing loss.

212.2 HAZARD INFORMATION

Excessive noise exposure can cause both temporary and permanent effects on hearing. The temporary effects of excessive noise include ringing in the ears, interference with communication, and hearing threshold changes. The effect of long-term excessive noise includes varying degrees of noise induced hearing loss.

The damaging effects of noise are dependent on the noise intensity (decibels), the time of exposure, the noise frequency (Hertz), and individual susceptibility. The Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs) and American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) set exposure limits based on exposure per day (in hours) and sound intensity (in decibels A scale or dBA). Exposures above these limits require use of hearing protection (plugs or muffs) to reduce the sound level or the use of noise engineering controls to reduce the sound level.

It is known that noise intensity above 85 dBA for prolonged periods will induce hearing loss. Eighty-five dBA represents a noise level where normal conversation is difficult and individuals will be shouting or talking into the ear of the person to be understood.

212.6 TRAINING

All workers required to wear hearing protectors will be trained in their proper use. In addition, all workers who may be exposed to greater than 85 dBA will be provided refresher training. This training will include at least the following: (1) Effects of noise on hearing; (2) the purpose, selection, fitting, use and care of hearing protectors; and (3) the purpose of audiometric testing and an explanation of the test procedure.

212.7 HEARING PROTECTORS

When hearing protectors are required the employee must have received training on the proper use. Proper noise reduction ratings will be applied by the HSO/CHSO to the noise in the environment.

Hearing protectors act as barriers to reduce sound entering the ear. Noise Reduction Ratings (NRR) for each product reflects the effectiveness of the protector chosen. Generally, muffs offer a greater NRR (25-30 dBA) than plugs (15-25 dBA). Comfort is an important factor when wearing ear protection over many hours; it is recommended to try different types of plugs or muffs to determine the best combination of comfort and fit.

212.8 AUDIOMETRIC TESTING

Audiograms are administered upon employment and annually/biennially thereafter. The audiograms are conducted by the medical clinics approved for W-C physicals and must meet all the applicable requirements (including Appendices C, D, and E of the OSHA Std. Title 29 Code of Federal Regulations (CFR) 1910.95). The local medical clinic in consultation with Greaney Medical will comply with applicable provisions of Title 29 CFR 1910.95(g) with regard to recordkeeping.

212.9 ACCESS TO INFORMATION, RECORDKEEPING

Each office shall have a copy of Title 29 CFR 1910.95 available for any employee requesting access to the standard. Employee training aids shall also be available to any employee. All noise monitoring data shall be retained for at least two years and Greaney Medical shall

OPERATING PROCEDURE NO. HS-213

213.0 TICKS AND TICK-BORNE DISEASES

213.1 PURPOSE

The purpose of this Operating Procedure (OP) is to provide information to Woodward-Clyde (W-C) employees regarding the diseases transmitted by ticks, particularly Lyme disease, and how to reduce employee risk.

213.2 TICK-BORNE DISEASES

Tick-borne diseases represent a significant health risk in many parts of the world. The risk to W-C field staff depends on the work location, the time of year, the clothing worn and other factors. Ticks are documented vectors of virus and bacteria for diseases such as Lyme disease (North America, Europe), Rocky Mountain Spotted Fever (North America), Encephalitis, (Asia, Africa), Boutonneuse Fever (Africa, India, Middle East), and Rickettsiosis (Asia).

While specific information in this OP is limited to Lyme disease, the risk control measures apply to other tick-borne diseases.

213.3 LYME DISEASE

Lyme disease is caused by a coiled bacteria known as a spirochete and is most commonly transferred to humans through ticks. The disease has been found in almost all U.S. states and in Europe, but is most common in locations with a mixture of wooded areas and grasslands. The Lyme disease infection is spread in the wild by tick bites on animals, particularly mice and deer, and infection can include domestic animals such as cats, dogs, and cows. While a number of ticks can transfer Lyme disease, the very small deer tick is the most common.

The tick bite is usually not painful and because of the small size of the deer tick, is often not noticed. In most cases, the tick simply draws blood for its nourishment and after a few days

Follow label directions carefully for use of tick repellents as many are designed for use on clothing, not on skin. Repellent use should be in combination with proper clothing and is most recommended for the ankles and wrists.

After working in an area of possible tick exposure, it is recommended that the individual shower promptly and check for any ticks. If a tick is found on the skin, remove it promptly using tweezers or forceps, followed by disinfection with alcohol or iodine. It takes several hours for a tick to attach and feed; removing it promptly lessens the chance of being infected.

OPERATING PROCEDURE NO. HS-301

301.0 SELECTION AND USE OF RESPIRATORY PROTECTION EQUIPMENT

301.1 PURPOSE

The purpose of this Operating Procedure (OP) is to provide information for the proper selection of respiratory protection equipment. It is to insure that respirators are properly selected and used in accordance with Occupational Health and Safety Administration (OSHA) requirements. Respirators must be selected on the basis of the hazards to which personnel are or may potentially be exposed.

301.2 REQUIREMENTS

The OSHA standards found in Title 29 of the Code of Federal Regulations, Section 1910.134 establishes requirements for respiratory protection programs, which is summarized in the following eleven major points:

1. Establish Written Operating Procedures - A formal written document outlining aspects of the respiratory protection program must be developed.

2. Respirator Selection - Proper selection of respirators shall be made according to the guidance of American National Standards Institute (ANSI) Z88.2-1980. In choosing respirators, consider the nature and extent of the hazard, the work requirements and conditions, and the characteristics and limitations of the respirators available. When examining the hazardous environment, some of the questions that should be asked are:

   - What are the contaminants?
   - What are their concentrations?
   - Are they gaseous or particulate?
   - Do they have adequate warning properties?
   - Are concentrations immediately dangerous to life or health?

9. Continually Enforce and Evaluate the Respirator Program -No matter how well the written standard operating procedures are drawn up, the program cannot be effective if it is not enforced. Frequent random inspections shall be conducted by a qualified individual to assure that respirators are properly selected, used, cleaned, and maintained. If defects are found, corrective action should be taken.

10. Medical Evaluation of Respirator Wearers - If a potential respirator wearer is not physically able to perform the work using a respirator, the use of a respirator may create more problems than it solves. A physician should be consulted to make sure each respirator wearer is physically qualified.

11. Use Approved or Accepted Respirators - The respirators you use in your work environment must be National Institute of Occupational Safety and Health (NIOSH)/Mine Safety and Health Administration (MSHA) certified, where applicable, or be otherwise accepted to provide adequate protection for the hazards encountered.

301.3 SELECTION

A summary diagram of the respirator selection process is presented in Figure 301-1. It provides an overview of the decision logic that should be used during selection of respiratory protection equipment. A listing of specific decision considerations is presented below.

1. What is the estimated contaminant concentration where the respirator will be used, as determined by industrial hygiene monitoring information.

2. What is the Permissible Exposure Limit (PEL) to the contaminant, Threshold Limit Value (TLV), and Short-Term Exposure Limit (STEL)?

   Health standards for many specific substances are available. OSHA Standard 1910.1000, Tables Z1, Z2, and Z3 gives the required PEL's when no health standards supersede these tables. However, since these tables are established from the 1969 TLV list, good industrial hygiene practice would base respirator selection on current TLV's, if lower, or other new toxicity data.

Frequently, this will be self-evident if the operation is in progress. This information, too, is available from the Material Safety Data Sheets of raw materials. For irritant materials, a full facepiece respirator should be employed.

8. If the contaminant is a gas or vapor, is there any available sorbent that traps it efficiently?

   Respirator manufacturers and/or industrial hygienists can provide this information.

9. Can the contaminant be absorbed through the skin as a vapor or liquid? If so, will it significantly add to the employee's exposure and cause injury?

   Skin absorption is indicated in the OSHA Standard 1910.1000, Table Z1 by the notation "skin" after the material name. Material Safety Data Sheets will also indicate skin absorption potential.

10. What is the size of the employee's face?

    Some manufacturers offer the same model respirator in two or three sizes. This will help to fit most employees properly with one brand of respirator.

11. What types of respirators will give the required Maximum Use Concentration (MUC)?

    The MUC is a measure of the degree of protection provided by a respirator to a wearer. It takes into account the respirator limitations and the ability of a user to get a satisfactory fit. Multiplying the PEL (or STEL) by the protection factor assigned to a respirator gives the MUC of the hazardous material for which the respirator can be used.

$$MUC = PEL \times Protection\ Factor$$

A table of MUCs of various respirators for different contaminants is presented in Table 301-1.

- Fit the respirator as outlined in OP HS-302, Respirator Fit Testing.

- The cartridges may be used until the odor of the contaminant can be smelled, irritation occurs or the substance can be tasted by the wearer.

- Do not use cartridges after expiration date printed on the label.

- If the facepiece and cartridges are used by one employee and the cartridges are not used until exhaustion, they may be resealed after use, by the employee, and reused at a future time. This may be done until cartridge exhaustion.

- Inspect, clean and maintain respirators as outlined in OP HS-303, Respirator Inspection, Care, Maintenance and Storage.

- Most respirator manufacturers now supply a given model respirator in different sizes so that many employees can be fitted with a single brand of respirator.

301.5 SUPPLIED AIR RESPIRATORS

301.5.1 Self-Contained Breathing Apparatus (SCBA)

The self-contained breathing apparatus affords complete respiratory protection in any atmosphere for which the lungs are the principal route of entry into the body. They supply the wearer with cool, non-contaminated breathing air, as demanded by the wearer, at approximately ambient atmospheric pressure. For specific instructions on SCBA units, consult the SCBA manufacturer's manual.

6. Observe both gauges to see if they correspond, and check for air leaks in system.

7. Crack emergency bypass or release air from facepiece and slowly reduce air pressure on regulator gauge to determine that the audible alarm activates at the proper pressure.

8. Check:

- Condition of straps on harness.
- Tightness of screws and fasteners on:
  - straps
  - regulator bracket
  - all valve handles.
- Locking devices on:
  - main line valve
  - cylinder valve
  - carrier to secure cylinder.
- Holes in diaphragm cap on regulator to see if open.
- Facepiece:
  - should be clean
  - head band in good condition
  - exhalation valve not sticking or held open
  - inhalation valve not sticking or held open
  - speaking diaphragm and gasket in correctly.

9. Gaskets should be in good condition at:

- Regulator side of breathing tube.
- Facepiece where breathing tube connects.
- Speaking diaphragm assembly.
- O-ring in coupling that connects to cylinder valve.

10. Audible alarm bell cap is tight.

The use of air-line respirators requires proper securing of breathing air cylinders, regular observation of tank pressures to ensure an uninterrupted flow to workers, protection of the connecting hoses, specialized training of employees, and inspection of the equipment according to the specific manufacturers directions.

301.6 WARNINGS RELATED TO RESPIRATOR SELECTION AND USE

1. Failure to properly select the appropriate respirator for all the materials and concentrations to which the respirator wearer may be exposed may result in serious illness, disability, or death of the affected worker.

2. Only self-contained positive pressure breathing apparatus and pressure demand air-line respirators with auxiliary tanks are designed for use in:

   - Oxygen deficient atmospheres (an atmosphere of less than 19.5 percent oxygen by volume at sea level).

   - Poorly ventilated areas, or confined spaces such as tanks, small rooms, tunnels or vessels, unless the confined space is well ventilated and the concentration of toxic contaminants is known to be below the upper limit recommended for the respirator.

   - Atmospheres where the concentrations of toxic contaminants are unknown or are IDLH.

   - For fire fighting.

   - At concentrations of substances higher than the upper limits recommended for air purifying respirators.

3. Immediately leave the area and replace the respirator if:

   - Breathing becomes difficult;
   - Dizziness or other distress occurs;

Facial hair lying between the sealing surface of a respirator face piece and the wearer's skin will prevent a good seal. Except with positive pressure air-line respirators, powered air-purifying respirators, and pressure-demand SCBA, a negative pressure exists within the mask upon inhalation; a poor seal will permit contaminated air to enter the facepiece. Even a few days' growth of beard can permit contaminant penetration.

Respirators should not be worn when conditions prevent a good seal of the facepiece to the face. **Facial hair in the form of beards, mustaches, sideburns, and stubble should not be permitted on employees required to wear respirators, if the hair comes between the facepiece sealing surface and the face.**

301.7.2 Corrective Lenses

Employees wearing corrective eye glasses present a special problem with respect to respiratory protection. Spectacle temple bars, or straps that pass between the sealing surface of a full facepiece respirator and the wearer's face, prevent a good seal and thus must not be worn.

Spectacles with short temple bars that do not interfere with respirator sealing and are taped to the employee's face may be used temporarily. Special corrective lenses or spectacle inserts that can be permanently mounted inside a full facepiece respirator are available from most manufacturers. Such corrective lenses should be mounted in the facepiece such that it ensures good vision and comfort.

Spectacles or goggles may also interfere with quarter or half-mask sealing; in this case a full facepiece respirator should be employed.

Contact lenses shall not be worn while wearing a respirator in a contaminated atmosphere. Contaminants may get into the eyes and cause severe irritation and/or discomfort with quarter or half-masks. Full facepieces can pull at the side of the eye and pop out the lens.

301.7.3 Cold Weather Use of Respirator

Under cold weather conditions a number of problems can develop, such as fogging of full facepiece respirators, valve sticking and rubber stiffness that prevents good facial seal.

301.9 DISPOSABLE RESPIRATORY PROTECTION EQUIPMENT

The use of disposable respiratory protection devices eliminates the need to clean, disinfect, inspect and repair equipment. Since the cleaning and maintenance aspects of a respiratory protection program can require time and dollar expenditures, the use of equipment not requiring such services may be desirable in some instances. While the cost of disposable equipment may, in some cases, be higher than comparable reusable devises, this cost may be offset or recoverable by the savings of labor and capital investments for cleaning and inspection facilities.

Disposable chemical vapor or gas respirators might be used economically where limited numbers of this type of respirator are in use or where specific operations are performed infrequently.

301.10 REFERENCES

American Conference of Governmental Industrial Hygienists, TLVs, Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices Environment 1992-93, ACGIH, 6500 Glenway Avenue, Building D-5, Cincinnati, Ohio 45211-4438.

Respiratory Protection, A Manual and Guideline, American Industrial Hygiene Association, 1991.

American National Standard, Practices for Respiratory Protection ANSI Z88.2-1980, American National Standards Institute, 1430 Broadway, New York, New York 10018.

National Institute for Occupational Safety and Health, A Guide to Industrial Respiratory Protection, DHHS (NIOSH) Publication 87-116, September 1987, Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

National Institute for Occupational Safety and Health, Occupational Health Guidelines for Chemical Hazards, DHHS (NIOSH) Publication No. 81-123, January 1981, Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

OPERATING PROCEDURE NO. HS-302

302.0 RESPIRATOR FIT TESTING

302.1 PURPOSE

The purpose of this Operating Procedure is to identify and to establish respirator fit testing requirements and procedures.

302.2 REQUIREMENTS

In compliance with Occupational Safety and Health Administration (OSHA) regulation Title 29 Code of Federal Regulations (CFR) 1910.134, all Woodward-Clyde (W-C) employees whose job assignments require use of non-powered air-purifying respirators (APR) or air-supplied respirators (ASR) that operate in the demand mode, must be fit tested using the isoamyl acetate (IAA) and/or the irritant smoke (IS) test. Fit tests shall be performed to identify the brand and size of respirator that fits each employee and to facilitate final fitting adjustments in the field.

Fit tests must be recorded for each tested employee. The record shall include test dates and identify the brands, models, and sizes of respirators tested.

302.3 ISOAMYL ACETATE TEST

302.3.1 Isoamyl Acetate Test Equipment

- Isoamyl acetate (USP grade in bottles or in ampules).
- Two bottles for odor recognition testing.
- Test enclosure. A simple test enclosure can be constructed by cutting a small slit at the center of the closed end of a clear plastic bag and inserting the hook of a wire clothes hanger through the slit so that the bag will hang open side down. The bag should be at least 3 mil thick and approximately the size of a garbage bag (large size).

2. The wearer stands with his/her back towards a fume hood or other ventilation source and is asked to keep his/her eyes closed during the test. (Note: eyes must be closed even when full-face respirators are tested.)

3. With the wearer holding his/her head still, the tester lightly puffs smoke over the facepiece, holding the tube at least 2 feet from it. The volume of smoke should be kept minimal and the wearer's reaction observed between puffs.

4. If the wearer detects no leakage, the tester increases smoke density and moves the tube progressively closer to the wearer, but no closer than 6 inches. If no leakage is detected, exposure is continued while the wearer performs the activities listed in Section 302.5.

5. If no leakage is detected with and without head movements, a satisfactory fit can be assumed. However, if leakage is detected, smoke generation should be stopped and Steps 3 and 4 repeated after the wearer readjusts the facepiece and/or head straps.

6. If a respirator under test continues to leak, another respirator of the same brand, model, and size should be tried. If it does not pass the test, another size or another brand should be tried.

302.5 ACTIVITIES

If, during the IAA or IS test, no leakage occurs while the wearer is holding his/her head still, the test shall be continued while the wearer is instructed to perform the following activities:

1. Deep breathing as in heavy exertion. This activity should not be done long enough to cause hyperventilation.

2. Side-to-side, then up-and-down head movements (exaggerated).
3. Read the "Rainbow Passage." Must be loud enough to be heard by someone standing nearby.

HS-302
WOODWARD-CLYDE
HEALTH AND SAFETY TRAINING
RESPIRATOR FIT TEST RECORD

Name: _____ **Social Security No:** _____

Company/Office: _____ **Last Medical Exam:** _____

Fit Test Date: _____ **Corrective Lenses Needed:** Yes ☐ No ☐

Briefed on fundamental principles of respiratory protection, use, selection, inspection cleaning, maintenance and storage of equipment. Yes ☐ No ☐

Isoamyl acetate odor recognition Yes ☐ No ☐

	RESPIRATOR 1	RESPIRATOR 2	RESPIRATOR 3
Equipment Type			
Manufacturer's Name			
Model			
Size			
Facepiece Composition (Rubber Silicone)			

TEST PERFORMED	RESPIRATOR 1	RESPIRATOR 2	RESPIRATOR 3
Negative Pressure Test:	P ☐ F ☐	P ☐ F ☐	P ☐ F ☐
Positive Pressure Test:	P ☐ F ☐	P ☐ F ☐	P ☐ F ☐
Isoamyl Acetate Vapor Test:	P ☐ F ☐	P ☐ F ☐	P ☐ F ☐
Irritant Smoke Test:	P ☐ F ☐	P ☐ F ☐	P ☐ F ☐

The individual named above has been fit-tested according to procedures specified in Woodward-Clyde's Operating Procedure HS-302. This qualitative fit test protocol has been adapted from OSHA 29 CFR 1910 and 29 CFR 1926.

Examiner's Name (Please Print)	Examiner's Signature	Date

Employee's Signature	Date

OPERATING PROCEDURE NO. HS-303

303.0 RESPIRATOR INSPECTION, CARE, MAINTENANCE, AND STORAGE

303.1 PURPOSE

The purpose of this Operating Procedure (OP) is to provide guidance on the proper care and use of respiratory protective devices, and to assist in adequately protecting personnel as well as complying with Occupational Safety and Health Administration (OSHA) respiratory protection standard Title 29 Code of Federal Regulations (CFR) 1910.134. Guidance in the selection of respiratory devices is provided in OP HS-301.

303.2 APPLICABILITY

This procedure is applicable for use in caring for half-face and full-face respirators of either air-purifying or air-supplying type. Proper care of respirators is essential for their satisfactory performance. Of importance is respirator inspection, care, maintenance, and storage.

303.3 REQUIREMENTS

OSHA requires, as part of an inspection program, that all respirators be leak checked, a determination that the complete assembly is gas tight. Follow field inspection procedures to examine the freshly cleaned, reassembled respirator.

"Cleaning and Disinfecting" - OSHA 1910.134 states "routinely used respirators shall be collected, cleaned and disinfected as frequently as necessary to ensure that proper protection is provided..." and that emergency use respirators "shall be cleaned and disinfected after each use."

The OSHA standard states that "replacement or repair shall be done by experienced persons with parts designed for the respirators." Besides being contrary to OSHA requirements, **substitution of parts from a different brand or type of respirator invalidates approval (i.e.,**

- Cracked or broken air-purifying element holder(s), badly worn threads or missing gasket(s), if required.

2. Examine the head straps or head harness for:

   - Breaks;
   - Loss of elasticity;
   - Broken or malfunctioning buckles and attachments; and
   - Excessively worn serrations on head harness, that might permit slippage (full facepieces only).

3. Examine the exhalation valve for the following after removing its cover:

   - Foreign material, such as detergent residue, dust particles or human hair under the valve seat;
   - Cracks, tears or distortion in the valve material;
   - Improper insertion of the valve body in the facepiece;
   - Cracks, breaks, or chips in the valve body, particularly in the sealing surface;
   - Missing or defective valve cover; and
   - Improper installation of the valve in the valve body.

4. Examine the air-purifying element for:

   - Incorrect cartridge, canister or filter for the hazard;
   - Incorrect installation, loose connections, missing or worn gasket or cross threading in the holder;
   - Expired shelf-life date on the cartridge or canister; and
   - Cracks or dents in the outside case of the filter, cartridge or canister, indicated by the absence of sealing material, tape, foil, etc., over the inlet.

5. If the device has a corrugated breathing tube, examine it for:

   - Broken or missing end connectors;

3. Examine the air-supply systems for:

   - Integrity and good condition of air-supply lines and hoses, including attachment and end fittings; and

   - Correct operation and condition of all regulators, or other air flow regulators.

In addition to the above, for self-contained breathing apparatus (SCBA) units also determine that:

1. The high pressure cylinder of compressed air is sufficiently charged for the intended use, preferably fully charged.

2. On closed-circuit SCBA, a fresh canister of CO_2 (carbon dioxide) sorbent is installed.

3. On open-circuit SCBA, the cylinder has been recharged if less than 25 percent of the useful service time remains.

All SCBAs are required to have a warning device that indicates when the 25 percent level is reached. However, it is recommended that an open-circuit SCBA be fully charged before use.

The specific inspecting procedures for the brand of air-line or SCBA equipment should be followed.

303.4.3 Respirator Disassembly

The used respirators should be collected and deposited in a central location. They are taken to an area where the filters, cartridges or canisters are removed and discarded. Canisters should be damaged or marked to prevent accidental reuse. If facepieces are equipped with reusable dust filters, they may be cleaned with compressed air in a hood. This prevents dust from getting into the room and affecting the respirator personnel. If

When a relatively small number of respirators are used, or where workers clean their own respirators, the generally accepted procedure is washing with detergent and warm water using a brush, thoroughly rinsing in clean water, and drying in a clean place. Precautions should be taken to prevent damage from rough handling during this procedure.
When large numbers of respirators are used, it is recommended that centralized cleaning and maintenance be performed and that specialized equipment and personnel trained in respirator maintenance be utilized.

303.5.1 Cleaning and Sanitizing

The actual cleaning may be done in a variety of ways. A commercial dishwasher can be used. A standard domestic clothes washer may also be used if a rack is installed around the agitator to hold the facepieces in fixed positions. If the facepieces are placed loosely in the washer, the agitator may damage them. A standard domestic dishwasher may be used, but it is not preferred because it does not immerse the facepieces. Any good detergent may be used followed by a disinfecting rinse or a combination disinfectant-detergent for a one step operation. Disinfection is not absolutely necessary if the respirator is reused by the same person. However, where individual issue is not practical, disinfection is strongly recommended. Reliable, effective disinfectants may be made from readily available household solutions, including:

1. Hypochlorite solution (50 ppm of chlorine) made by adding approximately two milliliters of bleach (such as Chlorox) to one liter of water, or two tablespoons of bleach per gallon of water. A two-minute immersion disinfects the respirators.

2. Aqueous solution of iodine (50 ppm of iodine) made by adding approximately 0.8 milliliters of tincture of iodine per liter of water, or one teaspoon of tincture of iodine per gallon of water. Again, a two-minute immersion is sufficient.

If the respirators are washed by hand, a separate disinfecting rinse may be provided. If a washing machine or dishwasher is used, the disinfectant must be added to the rinse cycle;

303.6 MAINTENANCE AND REPAIR

Maintenance personnel must be thoroughly trained. They must be aware of the limitations and never try to replace components or make repairs and adjustments beyond the manufacturer's recommendations, unless they have been specially trained by the manufacturer.

These restrictions apply primarily to maintenance of the more complicated devices, especially closed- and open-circuit SCBAs, and more specifically, regulator valves and low pressures warning devices. These devices should be returned to the manufacturer or to a trained technician for adjustment or repair. There should be no major problems in repairing and maintaining most respirators, particularly the commonly used air-purifying type.

An important aspect of any maintenance program is having enough spare parts on hand. Only continual surveillance of replacement rates will determine what parts and quantities should be kept in stock. It is desirable to have a recording system to indicate spare parts usage and the inventory on hand.

For SCBA devices, the facepiece should be combined with the tested regulator and the fully charged cylinder, and an operational check performed.

303.7 RESPIRATOR STORAGE

Damage and contamination of respirators may take place if they are stored on a workbench, or in a tool cabinet or toolbox, among heavy tools, greases and dirt. Freshly cleaned respirators should be placed in heat-sealed, ziplock, or other reusable plastic bags until reissue. They should be stored in a clean, dry location away from direct sunlight. They should be placed in a single layer with the facepiece and exhalation valve in an undistorted position to prevent rubber or plastic from taking a permanent distorted "set."

Air-purifying respirators kept ready for non-routine or emergency used should be stored in a cabinet with individual compartments. The storage cabinet should be readily accessible, and all workers should be made aware of its location, as is done for fire extinguishers.

Birkner, L.R., Respiratory Protection A Manual and Guideline, American Industrial Hygiene Association, 1991.

OPERATING PROCEDURE NO. HS-304

304.0 SELECTION AND USE OF PERSONAL PROTECTIVE EQUIPMENT

304.1 PURPOSE

The purpose of this Operating Procedure (OP) is to set forth the criteria and methodology to be used in selecting personal protective equipment (PPE). This OP has been developed to help Woodward-Clyde (W-C) employees select the appropriate PPE and reduce the risk of occupational injury or illness.

304.2 GENERAL

Personal protective equipment is a means of isolating a worker from a hazard. Use of personal protective equipment places a high degree of responsibility for safety on the field worker. Exposure can occur during lapses in standard operating procedures, failure of protective equipment, removal of protective equipment at the end of work periods, or use of improper or damaged equipment. However, a properly administered personal protective equipment program can offer an effective means of control or as a supplement or backup to controls at the source of hazards.

Personal protective equipment can be divided into three categories:

- Safety equipment (e.g., hard hats, shoes, safety glasses, face shields);
- Protective clothing (e.g., gloves, aprons, coveralls); and
- Respiratory devices (e.g., half and full-face air-purifying respirators, supplied air respirators, and self-contained breathing apparatus (SCBAs)).

The proper selection of personal protective equipment is an extremely important task. The use of improper equipment can result in the lack of protection from a specific hazard

304.4.3 Foot Protection

W-C employees working at field sites shall wear sturdy, closed toe shoes or boots. Specific footwear such as rubber boots, steel toe shoes, or overboots will be used as appropriate to the type of hazards and according to the safety plan or client requirements. If safety shoes or boots are worn, they shall meet the requirements of ANSI Z 41.

304.4.4 Hearing Protection

W-C employees working on tasks where the noise level is above 85 dBA (a level difficult to hear normal conversation) shall use hearing protection such as plugs or muffs to reduce the noise level. Detailed information may be seen in the W-C Hearing Conservation Program, Operating Procedure HS-212.

304.5 LEVELS OF PROTECTION FOR HAZARDOUS WASTE SITES

Potential hazards associated with contaminants may be minimized by utilizing appropriate personal protective equipment. Personal protective equipment to protect the body against contact with known or anticipated chemical hazards has been divided into four categories (i.e., Levels A, B, C, or D) according to the degree of protection afforded. Level A provides the greatest degree of personal protection while Level D provides the least. A summary of the four levels of protection is presented in Table 304-1. The protection to be used will be specified in the site Health and Safety Plan.

304.6 PROTECTIVE CLOTHING

The category of protective clothing includes: clothing, gloves, and aprons. The choice of clothing to be used should be based on the potential exposure hazards anticipated, the amount of body coverage required, and the material used in clothing construction. To protect the wearer from exposure, the clothing material should be impermeable or at least resistant to the particular hazardous agents expected to be encountered.

Data on the suitability of various types of protective clothing for particular hazards are often limited to manufacturers' bulletins, brochures, or information services. Literature on

TABLE 304-1
Sample Protective Ensembles
page 1 of 2

LEVEL OF PROTECTION A			
Equipment	**Protection Provided**	**Should be Used When:**	**Limiting Criteria**
RECOMMENDED: • Pressure-demand, full-facepiece SCBA or pressure-demand supplied-air respirator with escape SCBA. • Fully-encapsulating, chemical-resistant suit • Inner chemical-resistant gloves. • Chemical-resistant safety boots/shoes. • Two-way radio communications. **OPTIONAL:** Hard hat. Coveralls. Cooling unit. Long cotton underwear. Disposable gloves and boot covers.	The highest available level of respiratory, skin, and eye protection.	1. The chemical substance had been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on either: - measured (or potential for) high concentration of atmospheric vapors, gases, or particulates; or - site operations and work functions involving a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials that are harmful to skin or capable of being absorbed through the intact skin. 2. Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible. 3. Operations must be conducted in confined, poorly ventilated areas until the absence of conditions requiring Level A protection is determined.	Fully encapsulating suit material must be compatible with the substances involved.

LEVEL OF PROTECTION B			
Equipment	**Protection Provided**	**Should be Used When:**	**Limiting Criteria**
RECOMMENDED: • Pressure-demand, full-facepiece SCBA or pressure-demand supplied-air respirator with escape SCBA. • Chemical-resistant clothing (overalls and long-sleeved jacket; hooded, one- or two-piece chemical splash suit; disposable chemical-resistant one-piece suit). • Inner and outer chemical-resistant gloves. • Chemical-resistant safety boots/shoes. • Hard hat. • Two-way radio communications. **OPTIONAL:** Coveralls. Face shield. Disposable boot covers. Long cotton underwear.	The same level of respiratory protection but less skin protection than Level A. It is the minimum level recommended for initial site entries until the hazards have been further identified.	1. The type and atmospheric concentration of substances have been identified and require a high level of respiratory protection, but less skin protection. This involves atmospheres: - with IDLH concentrations of specific substances that do not represent a skin hazard; or - that do not meet the criteria for use of air-purifying respirators. 2. Atmosphere contains less than 19.5 percent oxygen. 3. Presence of incompletely identified vapors or gases is indicated by direct-reading organic vapor detection instrument, but vapors and gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the intact skin.	Use only when the vapor or gases present are not suspected of containing high concentrations of chemicals that are harmful to skin or capable of being absorbed through the intact skin.

OPERATING PROCEDURE NO. HS-501

501.0 EMPLOYEE MEDICAL SURVEILLANCE

501.1 PURPOSE

Medical surveillance is a major component of the Woodward-Clyde (W-C) health and safety program. It was established to monitor and promote the health of employees engaged in projects which have the potential for exposure to hazardous substances.

501.2 OBJECTIVES

The objectives of the medical surveillance component of the health and safety program are:

- To reduce the health risk for employees assigned to work on hazardous material projects.
- Pre-assignment screening of employee's health to determine present status and to identify existing problems that may be aggravated by chemical exposures or physical stress.
- Monitoring employee health for early signs of work-related illness and employee suitability for further field or laboratory assignments on sites containing potentially hazardous substances.
- Evaluation and care of individuals with work-related illnesses or injuries.
- Satisfy the requirements of Occupational Safety and Health Administration (OSHA) Title 29 Code of Federal Regulations (CFR) 1910.134 regarding respiratory protection and OSHA 1910.120 for hazardous waste workers.

in case of known or suspected exposures to toxic substances. Any special tests performed depend on the chemical substance to which the individual has been exposed.

The site safety plan must address emergency medical care and treatment of personnel, including possible exposures to toxic substances and injuries due to physical hazards. The following items should be considered in emergency care provisions.

- The name, address, and telephone number of the nearest medical treatment facility should be conspicuously posted. A map and/or directions for locating the facility, plus the travel time, should be readily available.

- The facility's ability to provide care and treatment of personnel exposed or suspected of being exposed to toxic (or otherwise hazardous) substances should be ascertained.

- Arrangements should be made to quickly obtain ambulance, emergency, fire, and police services. Telephone numbers and procedures for obtaining these services should be conspicuously posted.

- Emergency showers, eye wash fountains, and first aid equipment should be readily available on-site. The Site Safety Officer (SSO) should have first aid training.

- Provisions should be made for rapid identification of the substance to which the worker has been exposed (if this has not previously been done). This information must be provided to medical personnel.

Under Part 1910.134, OSHA requires medical clearance for those required to wear respirators. Individuals with existing health conditions, such as emphysema, may be excluded from respirator use due to potential health effects.

compounds are in effect. Special testing should be cleared and scheduled by Greaney Medical Group.

501.6 EXAMINATION PROTOCOLS

The protocols presented in Table 501-1 apply to baseline, annual, and exit examinations. A detailed health/work history questionnaire is provided before baseline and routine examinations. The protocols may be expanded by the reviewing or examining physician after consultation with W-C.

501.7 EXAMINING PHYSICIAN

Examining physicians will review the information provided by the employee in the questionnaire, examine the employee, and perform laboratory tests. The examining physician will provide the results of the examination to the W-C reviewing physician for final evaluation of employee suitability for work at hazardous material sites. The reviewing physician's conclusions shall supersede those of the examining physician. The examining physician will be contracted directly to Greaney Medical Group.

501.8 REVIEWING PHYSICIAN

Dr. Peter Greaney, Greaney Medical Group of Anaheim, California has been retained to provide medical oversight to the W-C medical surveillance program. The reviewing physician receives copies of all medical questionnaires, examinations, and laboratory testing results, reviews the reports of examining physicians, and determines an employee's fitness for work at hazardous material sites. The reviewing physician also provides advice and assistance regarding site specific medical monitoring needs and programs.

Employer reports received by W-C shall be reviewed by the HSO and kept in the Operating Unit's health and safety file. Physician recommendations regarding limitations must be followed.

501.9.1 Not Qualified Reports

In the event that a **not qualified** status is determined or prompt medical attention is needed for an employee, GMG will notify the employee and the HSO by phone immediately.

If a W-C employee does not take a W-C physical examination and the GMG staff has made three attempts to contact the employee over a one month period, GMG will issue a Not Qualified - Health Status Medical Employer Report.

501.10 EMPLOYEE MEDICAL SURVEILLANCE PROGRAM DATABASE

The employee medical surveillance program includes a computerized database which stores and processes employee medical surveillance information such as medical clearance results, training and respirator fit testing data. The purpose of the database is to facilitate record documentation, the reviewing physician's evaluation of the medical surveillance data, and administration of the W-C Health and Safety Program. Administrative and quality control features include: profile reports on employee eligibility for site work, medical examination scheduling reports, training requirement notices, and listing of qualified staff by operating unit and firmwide. The reports are shown as part of Table 501-2.

501.11 CONFIDENTIALITY - MEDICAL RECORDS

Employee medical records are confidential and available for review only by the examining and/or reviewing physicians and their medical personnel. Only the work clearance status and any work limitations are provided to W-C.

Each employee can obtain information on his/her health by asking the examining physician for the information at the time of, or after, an examination. The employee may also request release of records or information, and/or designate a representative, in a letter to the physician. The request must contain the full name and address of the representative and

TABLE 501-1
MEDICAL EXAMINATION PROTOCOL
pg 1 of 4

Test	Testing Frequency			Remarks
	Baseline	Annual	Exit	
Height and Weight	X	X	X	
Blood Pressure	X	X	X	
Pulse (resting)	X	X	X	
Temperature (oral) Fahrenheit	X	X	X	
Vision Snellen (R&L)		X	X	
Vision Titmus (R&L)	X			
Near-corrected & Uncorrected				
Far-corrected & Uncorrected				
Peripheral (Visual Field)				
Color				
Audiogram	X	X	X	
Pulmonary Function Test	X	X	X	
CBC Count (Hemogram)	X	X	X	
WBC				
RBC				
HGB				
HCT				
MCV				
MCH				
MCHC				

TABLE 501-1
MEDICAL EXAMINATION PROTOCOL

Test	Testing Frequency			Remarks
	Baseline	Annual	Exit	
Cardiogram	X	*See Remarks	*Note	Every 3 years for less than or equal to 40 years old. Every year for more than 40 years old. *NOTE: For Exit exam, EKG performed only if not performed in past year.
Treadmill	*See Remarks	*See Remarks		Only if: *Abnormal EKG (except sinus bradycardia, unless an otherwise healthy person) or *History of angina or *History of myocardial infarction (MI) or *History of cardiac surgery.

TABLE 501-5
NIDA 5 DRUG TESTING THRESHOLD LEVELS

	Screening Limit	Confirming Limit
Cocaine	300 ng/mls	150 ng/mls
Marijuana Cannabinoids	100 ng/mls	15 ng/mls
Opiates	300 ng/mls	300 ng/mls
Phencyclidine (PCP)	25 ng/mls	25 ng/mls
Amphetamines	1000 ng/mls	500 ng/mls

Source for NIDA 5 Levels - SmithKline Bio-Science Laboratories; "Substance of Abuse-Testing in the Workplace".

NOTES:

1. Clients that require drug testing will list drugs and threshold levels in their contract. If the contract states NIDA 5 testing, then the above list can be used.

   When the threshold level for marijuana is lower than the above referenced levels, then the client is probably testing for passive use.

2. DOT testing requires the NIDA 5.

3. Drug testing is not part of the standard W-C Medical Surveillance Program. Drug testing is performed due to client or DOT requirements or for cause.

OPERATING PROCEDURE NO. HS-502

502.0 HEALTH AND SAFETY RECORDS

502.1 PURPOSE

Proper recordkeeping allows evaluation of health and safety effectiveness and meets regulatory requirements.

502.2 OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) LOGS

OSHA requires most industries to maintain the OSHA Log and Summary (OSHA No. 200) and the OSHA Supplemental Record (OSHA No. 101). Woodward-Clyde (W-C) is exempt from OSHA recordkeeping requirements (29 Code of Federal Regulations (CFR) 1904.16) due to the Standard Industrial Classification Code (SIC) of Architectural and Engineering Services. However, W-C will voluntarily maintain OSHA Logs for use in evaluating Health and Safety Program effectiveness and in providing statistical information to clients.

OSHA logs will be maintained by the Workers Compensation Coordinator in WCGI Human Resources with a minimum retention time of five years.

502.3 TRAINING

W-C health and safety training records will be maintained by the Operating Unit Health and Safety Officer (HSO)/Health and Safety Coordinator (HSC) and the WCGI Health and Safety Department. Original W-C training attendance sign-in sheets, evaluation forms, examinations and respirator fit tests shall be provided to the WCGI Health and Safety Department and will be maintained indefinitely.

Documentation of training for employees that received their training at other firms must also be provided to the WCGI Health and Safety Department.

Training information will be entered into the W-C Health and Safety database and provided as part of the monthly profile reports to HSOs/HSCs.

for thirty years in compliance with OSHA (CFR 1910.20) requirements for record retention. Employees have the right to review and copy relevant exposure monitoring information from field log books or other sources.

APPENDIX B 3

W-C'S PERSONNEL TRAINING STATUS

REQUIRED PERSONNEL TRAINING

	Medical Clearance	OSHA 40-hour Training	OSHA Supervisory Training	First Aid*	CPR*
PROJECT MANAGER Dean Parson	X	X			
TASK MANAGERS Barry O'Melia	X	X	X		
FIELD SUPERVISORS Jeanette DuBois Bill Fronczak, Dave Nicholson, Nick Gomez, Mike May, Nan Elzinga Others	X	X	X		
SITE HEALTH AND SAFETY COORDINATOR Gregg Miller Alternates	X	X	X	X	X
HEALTH AND SAFETY TECHNICIANS Tracy Hines Doug Schroer Kent Trimbach Bob Lahn Alternates	X	X		X	X
FIELD STAFF Michael Ryan Rock Powell Others	X	X			

NOTES: X = Required Training
* = At least one person per shift will have First Aid and CPR training

Soil Vapor Extraction - Operable Unit 2

Personnel Training Status

Name		Physical Exam	W-C Respirator Fit Test	Training						Rocky Flats Training				
				24/40 Hour (OSHA)	Refresher (OSHA)	Supervisor	Level B	CPR	First Aid	SVE QA Training	SVE System Operation	GET	RAD Worker II	Other (see legend)
		annual	annual	once	annual	once	once	annual	3 years	once	once	once	3 days	
DuBois	Jeanette	11/16/93	3/16/93	3/18/93	N/A	3/13/94						1/8/93	1/19/94	HC,EN
Eckert	Ron	8/27/93	9/8/93	9/10/93	N/A	N/A	N/A	N/A	N/A	9/23/93		9/17/93	9/15/93	CA,OJT,HC,EN,MSDS
Elzinga	Nan	4/6/93	1/15/93	1/24/92	1/15/93	8/20/93	N/A	7/16/92	7/15/92	9/23/93			10/4/93	OJT,HC,MSDS,EN,CA
Fischer	Kathleen	5/26/93	8/9/93*	6/5/92	5/7/93	9/25/92	8/24/93	12/10/92	12/9/92	9/23/93		3/19/93	10/13/93~	OJT,HC,EN,CF,CST
Fronczak	Bill	4/23/93	7/29/93*	6/7/92	4/9/93	9/30/91	9/6/91	12/10/92	12/9/92	9/23/93		11/19/92	10/17/93	CF,OJT,HC,MSDS,CA,EN,CST
Gomez	Nicholas	5/20/93	5/7/93	6/7/91	5/7/93	9/30/91	9/6/91	12/10/92	12/9/92	9/23/93		3/19/93	10/17/93	CST,CA,OJT,HC,EN
Hines	Tracy	4/20/93		5/21/93	N/A	8/20/93	8/24/93	7/14/93	7/15/93			4/30/93	1/19/94	CST
Lahm	Bob	1/18/93~	7/8/93	12/19/88	7/8/93	12/1/90	8/24/93	11/21/92	7/9/91			9/22/92	11/3/93	HC,EN,HZ,CST
May	Michael	1/25/94~	1/15/93*	2/15/91	11/5/93	9/30/91	4/22/91	7/15/93	7/15/93	9/23/93		9/8/92	11/17/93	CA,OJT,HC,MSDS,EN
Miller	Gregory	5/19/93	N/A	8/20/88	11/5/93	5/10/91	4/22/91	9/1/92	9/1/92	9/23/93		9/8/92	7/30/93	EN,CA,OJT,MSDS
O'Melia	Barry	10/9/92~	11/6/92	11/22/91	11/6/92~	4/16/92	1/22/92	N/A	N/A	9/23/93		9/11/92	12/15/93~	CA,OJT,HC,EN
Parson	Dean	5/6/93	4/9/93	9/18/87	4/9/93	12/28/87	1/22/92	N/A	N/A	9/23/93		11/6/92		OJT,HC,EN
Powell	Rock	3/3/93	3/16/93	3/18/93	N/A	8/20/93	8/24/93	7/14/93	N/A			11/6/92	1/19/94	CST
Ross	Paula	9/10/93	11/5/93	10/14/88	11/5/93	10/13/89	1/22/92	1/13/93	1/13/93			11/20/92	~	
Ryan	Michael	7/15/93	7/29/93*	7/30/90	5/7/93	9/30/91	1/22/92	7/14/93	7/15/93	9/23/93		1/8/93	10/17/93	CF,SCBA,OJT,HC,MSDS,EN,CA,CST
Schroer	Douglas	9/22/93	7/29/93*	6/22/92	1/15/93	8/20/93	8/24/93	1/20/93	1/20/93	9/23/93		9/22/92	12/15/93	CF,SCBA,CA,OJT,HC,MSDS,EN,CST
Trimbach	Kent	1/26/93	7/18/93	12/3/88	7/8/93	10/6/90	4/22/91	1/20/93	1/20/93			9/22/92	1/19/94	CST
Dusterdick	Ron	8/5/93	N/A	8/23/93	N/A	N/A	N/A	N/A				~	~	HC

Legend:

CF - EG&G Confined Space Training
CST - EG&G Computor Security Training
DC - EG&G Datacap Training
HST - HST Training
HZ - EG&G Hazmat Training
SCBA - EG&G SCBA Training
CA - WC Compliance Agreement
OJT - WC On-The-Job Training
HC - WC Hazard Communications
MSDS - WC MSDS Training
EN - WC Emergency Notification
* - EG&G Resp. Fit Tested
~ - File Documentation Needed

APPENDIX B 4

AIRBORNE CONTAMINATION ESTIMATION

IDENTIFYING CHEMICAL HEALTH HAZARDS AND ESTIMATING WORKER EXPOSURES

This information is provided so that personnel will have a general understanding of how chemical health hazards are identified and the methodology employed to estimate the potential for those hazards to create injury/illness. This information incorporates procedures established in 29 CFR 1910.1200 Hazard Communication (1910.1200). Definitions provided in 1910.1200 are used herein. The W-C Hazard Communication Program is described in Operating Procedures HS-206 of the W-C Health and Safety Manual.

A literature search is the initial step in determining if a chemical is a health hazard or a carcinogen/potential carcinogen. The following data sources are reviewed.

- Hazardous substances are listed in
  - 29 CRF Part 1910, Subpart Z, Toxic and Hazardous Substances or
  - Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment, American Conference of Governmental Industrial Hygienists (ACGIH)
- Carcinogens/potential carcinogens are listed in
  - National Toxicology Program (NTP), Annual Report of Carcinogens
  - International Agency for Research on Cancer (IARC), Monographs
  - 29 CFR Part 1910, Subpart Z

If the chemical is a listed health hazard or a carcinogen/potential carcinogen, an estimate of the worker's potential exposure is accomplished.

If the chemical is not listed in one of the above sources of data and it comprises less than 0.1 percent by weight or volume, the chemical is considered to be an unlikely source of injury/illness and an exposure estimate is not normally accomplished.

If the chemical is not listed in one of the above data sources but does comprise greater than 0.1 percent by weight or volume, further research is required to determine whether the chemical is to be treated as a health hazard and therefore require that an exposure estimate be accomplished. Chemical health hazards have been divided into six classifications. Definitions of those classifications are established in Appendix A of 1910.1200. It is likely that a toxicologist will be needed to complete the research and conduct any needed hazard assessment.

The six classes of chemical health hazards are:

- Carcinogen
- Corrosive
- Irritant

- Sensitizer
- Highly Toxic
- Toxic

If the chemical is found to be a health hazard, an estimate of the worker's potential for exposure will be accomplished. Estimates of the worker's exposure are accomplished by considering the four primary routes of exposure: ingestion, injection, absorption, and inhalation.

The ingestion, injection, and absorption routes are potential sources of exposure that are likely to exist at each hazardous waste site. It is very difficult to do a prework estimate of a workers exposure via these routes, and it is very difficult to monitor those exposure routes as work progresses. Therefore, if chemical health hazards are known or suspected to exist at a work site, specific work practices and personal protective equipment (PPE) items will be needed to eliminate or minimize exposures via the ingestion, injection, and absorption routes. Those prudent work practices and PPE are developed on a site- and task-specific basis.

The inhalation route of exposure is also likely to exist at each hazardous waste site, but there are practical methods of estimating the worst case airborne concentrations of most substances. Raoult's Law (described below) is normally used to estimate the worker's potential exposure to chemical health hazards that could become airborne by vaporization from a fluid such as surface or groundwater.

RAOULT'S LAW:

$$\text{Mole Fraction} = \frac{\frac{\text{Mass}}{MW_c}}{\left[\left(\frac{\text{Mass}}{MW_c}\right) + \left(\frac{1 - \text{Mass}}{MW_w}\right)\right]}$$

Mass (in grams) = (mg/ℓ of contaminant)(1×10^{-6})

MW_c = molecular weight of contaminant

MW_w = molecular weight of water

p (mmHg) = (V_c)(mole fraction)

Vc = Vapor pressure of contaminant at temperature of fluids in question

P_a = air pressure in mmHg

$$\text{ppm of contaminant in air above fluid surface} = \left(\frac{P}{P_a}\right)(1 \times 10^6)$$

Example Problem:

Given:

- 1100 $\mu g/\ell$ of carbon tetrachloride, therefore Mass = $(1100 \times 10^{-3}\ mg/\ell)(1 \times 10^{-6})$ = 1.1×10^{-6} gm/gm
- MW_c = 153.8
- MW_w = 18
- V_c = 91 mmHg at 20° C
- Pa = 700 mmHg

$$\text{Mole Fraction} = \frac{\left(\frac{1.1 \times 10^{-6}}{153.8}\right)}{\left(\frac{1.1 \times 10^{-6}}{153.8}\right) + \left(\frac{1-1.1 \times 10^{-6}}{18}\right)} = 1.287388 \times 10^{-7}$$

$P = (91)(1.287388 \times 10^{-7}) = 1.1715123 \times 10^{-5}$

$$ppm = \left(\frac{1.171523 \times 10^{-5}}{700}\right)(1 \times 10^{6}) = 1.673604 \times 10^{-2} \approx 0.017 \text{ ppm of carbon tetrachloride}$$

The estimated maximum airborne concentrations derived by Raoult's Law are provided in Table E-1. A mass loading equation (described below) is normally used to estimate airborne concentrations of substances found in soils.

MASS LOADING EQUATION:

Maximum estimated airborne concentration = soil concentration x mass loading x unit conversion

Example problem:

Given:

Hexavalent - Chromium in soil at 5300 mg/kg
A mass loading of 15 mg/m^3
Estimate airborne concentration of hexavalent-chromium:

Maximum estimated airborne concentration = 5300 mg/kg x 15 mg/m^3 x 5300 mg/kg x 15 mg/m^3 x 1 $kg/10^6$ mg = 7.95×10^{-2} mg/m^3

The estimated maximum airborne concentrations derived by the mass loading equation are provided in Table E-2.

The estimated airborne concentrations are then considered in the context of site- and task-specific factors to make a prework decision regarding respiratory protection. Generally, air monitoring as work progresses is used to indicate on a real-time basis the worker's exposure to airborne concentration(s) of selected airborne indicator substances.